Temporal Gestures in Afrikaans

By

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DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof (unless to the extent explicitly otherwise stated) and that I have not previously, in its entirety or in part, submitted it for obtaining any qualification.

Linda-Vanessa Sabine Broders

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Abstract

This study investigated how first language Afrikaans speakers gesture about time, deliberately and spontaneously. This research aims to provide insight into what axis is referred to when thinking and speaking about time, and therefore further add research to the concept of the mental timeline. The main research questions for this study are "What axis do L1 Afrikaans speakers predominantly use when deliberately and spontaneously gesturing about time to indicate where the future and the past lies?", and "Concerning sagittal gestures, do L1 Afrikaans speakers spontaneously refer to an implicit temporal axis, which is reflected in the usage of hands when referring to time?". Both main questions have one main sub question. For the first one, is the sub question is "Do L1 Afrikaans speakers rely on the same spatial axis to talk about and spontaneously gesture about time?" For the second main question, the sub question goes as follows: "Is the lateral axis reflected in the right hand used for the future and the left hand used for the past?". It is further analysed how the deliberate and spontaneous gestures differ.

This study consisted of 96 Afrikaans first language speakers, of which 64 took part in the deliberate gestures experiment and 32 in the spontaneous gesture experiment. Overall, there were two types of conditions, the deictic and sequence temporal reference, and the spatial language and non-spatial language condition. These conditions were compared and analysed, and what affect they might have on the temporal gestures produced.

The results of this study reproduce and build on previous studies done on temporal gestures which have shown that the flow of time on either cultural artefacts (such as orthography and graphs) or spatio-temporal metaphors in a specific language influence how speakers anchor their temporal gestures on a certain axis. Findings showed that in these experiments, spatio-temporal language was the main influence amongst Afrikaans speakers. Further analysis also lead to the assumption that there is an implicit timeline, shown through the use of hands for the future and the past.

Opsomming

Hierdie studie het ondersoek ingestel na hoe moedertaal Afrikaanssprekendes, doelbewus en spontaan, gebare gebruik het om na tyd te verwys. Dit sal insig gee oor na watter as verwys word wanneer daar oor tyd gedink en gepraat word, en voeg daarom verdere navorsing tot die konsep van die mentale tydlyn. Die hoofnavorsingsvrae vir hierdie studie is: "Watter as gebruik L1 Afrikaans sprekers oorwegend wanneer daar bewustelik en spontaan beduie word oor tyd om aan te dui waar die toekoms en die verlede lê?" en "Met betrekking tot sagittale gebare, verwys die L1 Afrikaanse sprekers spontaan na 'n implisiete temporale as, wat weerspieël word in die gebruik van hande wanneer daar verwys word na tyd? ". Beide hoofvrae het een hoof-subvraag. Vir die eerste een is dit: "Maak L1 Afrikaans sprekers staat op dieselfde ruimtelike as om te praat en spontaan te gebaar oor tyd?". Vir die tweede hoofvraag lui die subvraag soos volg: "Word die laterale as weerspieël in die regterhand wat vir die toekoms en die linkerhand gebruik word vir die verlede?". Dit word ook ontleed hoe die doelbewuste en spontane gebare verskil.

Hierdie studie het bestaan uit 96 Afrikaans moedertaalsprekers, waarvan 64 deelgeneem het aan die doelbewuste gebare-eksperiment en 32 in die spontane gebare-eksperiment. Algeheel was daar twee tipes toestande, die deiktiese en volgorde-tydelike verwysing, en die ruimtelike taal- en nie-ruimtelike taalvoorwaarde. Hierdie toestande is vergelyk en ontleed, en watter invloed het dit op die tydelike gebare wat geproduseer word.

Die resultate van hierdie studie reproduseer en bou voort op vorige studies wat gedoen is oor temporale gebare, wat getoon het dat die vloei van tyd op kulturele artefak, soos ortografie en die vloei van grafieke, of die spatio-temporale metafore in 'n spesifieke taal invloed beïnvloed hoe sprekers hul tydelike gebare anker op 'n sekere as. In hierdie eksperimente is daar gevind dat spatio-temporale taal die hoofinvloed onder Afrikaanssprekendes was. Verdere ontleding lei ook tot die aanname dat daar 'n implisiete tydlyn is, wat getoon word deur die gebruik van hande vir die toekoms en die verlede.

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1. Introduction

It has been found that language and culture may influence various cognitive processes, including visual and emotional preferences, reasoning and perception in the numerical and magnitudinal fields, and sound, such as musical or auditory pitch. A further aspect that has been studied is time and how it is thought of. The present thesis focuses on temporal cognition, and how this is mediated by language and culture. The focus lies on how language and culture may influence how people map time onto space. Specifically, it is looked at how deliberate and spontaneous gestures are mapped onto space by using linguistic material.

The role that space plays in our construal of time can be seen in the metaphors that are used in that language. Such metaphors are used daily, such as “look ahead into the future”, or “we put the past behind us”. The tendency to map time onto space can furthermore be seen in different cultural artefacts, for example the flow of graphs and calendars, and the time on clocks. In these examples time is construed as flowing from one side of space to the other. In past studies, this has been referred to as the mental timeline, on which people make sense of events temporally.

The key factor that shapes our mental timeline is said to be experience. To be part of different cultures, speak different languages, and have different kinds of bodies, all contribute to creating specific experiences. These three key aspects of experience are referred to as cultural relativity, linguistic relativity, and bodily relativity. Together they fall under the umbrella term of experiential relativity. Cultural relativity, can include how the culture determines the flow of time when mapped onto space in orthography, calendars or clocks. Linguistic relativity can include how time is mapped onto space through language, for example “way *back* in the past” or “*ahead* in the future”, in which the italicized are the determining spatial markers that place the past towards the back and the future towards the front. As to bodily relativity, this concept refers to how the interaction between the body and the world mediates cognition. For instance, people often have a dominant side of the body and a non-dominant side. In other words, someone who has a dominant right hand might be more comfortable when using the right hand to execute activities. When the same person would try to execute the same activities with their non-dominant side, the left hand, then they would become frustrated very quickly, therefore seeing the activity and perhaps the world through a different emotional filter.

The main aims of this study were to investigate how Afrikaans first language (L1) speakers map time onto space in gestures. It therefore contributes with data on a language that has not been studied before, Afrikaans, and builds onto existing research about the mental timeline and how time is mapped onto space. This study adheres closest to the study done by Casasanto and Jasmin (2012), who investigated temporal gestures amongst English speakers.

1.1. Rationale of the study

Past studies that focused on time construal have researched how time is mapped onto space, and how this mapping is made visible through temporal gestures. The way gestures were made use of have been previously explained through the influence of either spatio-temporal metaphors or the flow of orthography. This leads to gestures being anchored either on the sagittal, the lateral or the vertical axis. The sagittal axis flows horizontally, from the front towards the back, or the other way around. The lateral axis also flows horizontally, but from the left towards the right, or again, the other way around. The vertical axis on the other hand flows from the top to the bottom, or vice versa. This thesis presents novel findings in such a way, that it not only looks at a language that has not been investigated before (which is Afrikaans), regarding temporal cognition, but it also takes the look at gestures a step further. Data collected clearly shows, that Afrikaans first language speakers tend to anchor their gestures onto the sagittal axis, for both the deliberate gestures elicited and the spontaneous gestures. However, it has come to the forefront, that in the deliberate gesture investigation, which is Experiment 1 in the current thesis, that a laterality effect is found in the hands used to gesture with on the sagittal axis. In other words, the left hand is predominantly used to gesture for the past, and the right hand is predominantly used to gesture for the future. As far as it is known, this has not been reported on in past studies. This may be explained through the existence of an implicit mental timeline that becomes clear through gestures. More detail on this in chapter 5 and 6. In this study, eye and brow movement have been added to the coding of the data, because a pattern started to emerge amongst participants. It became clear, that while the participants were talking about the future and the past, they did not only represent the mapping of time through their hands and head, but also through their eyes and brows.

1.2. Methodology

For experiment 1, which investigated deliberate gesture (i.e., gestures produced 'on demand' by participants), four questions in Afrikaans were used as primes (following Casasanto and Jasmin, 2012:650). These four questions were grouped into four main different conditions, deictic and sequence temporal reference, and the directional and non-directional language condition. Participants partook separately and all participants at different times, because the investigator presented the questions to the participants. For experiment 2, which investigated spontaneous gestures, four stories were used. They were constructed by the author and all had a different narrative from one another. The temporal conditions were the same as in the deliberate gesture investigation (i.e. there was a deictic and sequence temporal reference condition, and a spatial and non-spatial language condition). It is expected that the spatial and non-spatial language in both experiments elicit gestures anchored on either the sagittal or the lateral axis. Specifically, temporal gestures produced in the spatial language condition to be anchored more commonly on the sagittal axis, and on the lateral axis in the non-spatial language condition. For Experiment 2, spontaneous gestures were elicited in dyadic interactions, and participants were not initially aware of the fact that their gestures were being studied, since this would have defeated the purpose of looking at spontaneous gestures. In this regard, the participants did receive two separate consent forms, the one which was given to them before they started their experiment stating they were taking part in a story retelling experiment. The second consent form clearly explained that they were actually taking part in a temporal gesture investigation, which was also explained to them verbally. The procedure of these experiments can be found in chapter 4, while the stories used in the experiment, can be found in Addendum H.

1.3. Research questions

This study investigates on what axis Afrikaans first language speakers anchor their temporal gestures, in deliberate gesture and spontaneous gesture, primed in four different temporal conditions. This design is expected to give insight into how Afrikaans speakers think and speak about time, and how their mental timeline is constructed and mediates their mapping of time onto space. To address these aims, the following research questions are posed:

1. What axis do L1 Afrikaans speakers predominantly use when deliberately and spontaneously gesturing about the future and the past?
2. Concerning temporal gestures along the sagittal axis, do L1 Afrikaans speakers also exhibit an implicit lateral timeline, which is reflected in the usage of the right hand and left hand?
3. How far do deliberate and spontaneous gestures differ amongst L1 Afrikaans speakers?

1.4. Thesis structure

This thesis is structured into the following chapters:

Chapter 2 is the literature review, which provides an overview of past researches being done involving temporal gestures and the mental timeline. This chapter goes into further detail about what the mental timeline exactly is, how it is constructed (by cultural artefacts and language for example), and by what it could be influenced (cultural artefacts, for example). It then delves into the concepts of time, space and language, and how these are related to each other in temporal gesture studies.

Chapter 3 focuses on the theoretical framework of this thesis and starts off by going into more detail of gestures, what types there are and what phases they go through. It then moves onto abstract and concrete concepts, and discusses three main theories applicable to this thesis, namely the Conceptual Metaphor Theory, the Metaphoric Structuring View, and the Hierarchical Mental Metaphors Theory. After having looked at the gestural and linguistic theories, the experiential relativity hypothesis is discussed, followed by a thorough explanation of the temporal references deixis and sequence, which represent the different conditions used in this study.

Chapter 4 presents the methodology part of this thesis. This chapter describes the procedure of both experiments, as well as the material, and the technique used. It also gives feedback on the participants' background, and the inter-coder reliability.

Chapter 5 comprises the results of the study. It reports back all the data captured in both experiments, laid out into firstly looking at the axes used to anchor the deliberate temporal gestures (Experiment 1), then looking at the different conditions, while then moving onto the handedness sector of the thesis. In the second part of the results, which looks at the data from

spontaneous gestures (Experiment 2), additional information is given back regarding eye and brow movement, and alignment between temporal speech and temporal gestures.

Chapter 6 discusses the results. It looks at the predominant use of axes in both experiments, and the explanation for this. It also explains the possible existence of an implicit timeline made visible through the use of hands when gesturing for the future and the past. Furthermore, it also explains the congruency between temporal gestures and temporal speech and lastly the eye and brow movements and the alignment between temporal speech and temporal gestures.

The conclusion, lastly, will pull the main points of all the chapters and research questions together in a summary, while also looking at the contribution and value in general and for the theory and practice genre of psycholinguistic studies focusing on temporal gestures. Furthermore, it will discuss possible limitations of this study, how these could be rectified and could lead to further possible research.

2. Literature Review

2.1. Introduction

Metaphors are used every day, may it be in language, thought or portrayed through actions in physical reality. Conceptual systems, that we use to think and produce actions with are naturally metaphoric. We need and use concepts to structure what we perceive in the world. It helps us to manoeuvre around in reality and how we interact with other people that are in the same reality as us. The conceptual system that we make use of to make sense of reality plays a big role in day to day living. Lakoff and Johnson (1980) suggest that our conceptual system is largely metaphorical. This leads to the assumption that our way of thinking, experiencing and acting is based on metaphors. This conceptual system is not something that we are consciously aware of. It happens naturally and can be understood by investigating the languages that we speak. Interacting or communicating with others is based on the same conceptual system, that we also make use of when we think and act. Therefore, most of our conceptual system is naturally metaphorical (Lakoff and Johnson, 1980:4).

This chapter, which encompasses the literature review, will talk about time, language and space. These different concepts, which are central notions in this thesis, will be explained, and how the parts of this trio interact with each other. When examining this interaction, the relationship between time and space will be looked at, and how this link is visible in nonverbal behaviour. Then, it is explained how time is mapped onto space, a phenomenon which is here referred to as the mental timeline. This mental timeline can follow the sagittal axis (front-back), the lateral axis (left-right) or the vertical axis (up-down). The mental timeline is constructed and mediated by cultural artefacts, such as the reading and writing direction, or through spatial metaphors found in language. Lastly, a fourth factor will be introduced, and also forms part of the main focus of this thesis: gestures. In this section, the relation between temporal thought and gestures will be looked at, and how gestures give an insight into mental representations, and how these are formed.

2.2. Time, language and space

When talking about time, humans usually make use of spatial metaphors, due to time being an abstract concept. This produces a need to make time a tangible concept, which is where the

relationship between time and space begins (Bonato et al., 2012:2265; Núñez & Cooperrider, 2013:220; Radden, 2003:226; Boroditsky, 2000:4; Haspelmath, 1997:1; Evans, 2004:3-4; Bender et al., 2012:1). An example of a spatio-temporal metaphor could be *moving on into the future*, in which *into the future* is the spatio-temporal metaphor describing the future and being mapped towards the front in space. The relationship between time and space, however, is asymmetric, in which people can use spatial information to speak about time, but not use temporal information to speak about space. This is due to the domain of space being richer and more elaborate than the domain of time itself (Boroditsky, 2000:16; 24). The question arises if people think about time the same way they speak about it. Associations between temporal language and temporal thinking can be seen in speakers' spontaneous co-speech gestures (Casasanto, 2016b:169-170). This is where the conceptual link between time and space is seen when talking about time. Temporal representations may be directed by spatial primes (Boroditsky, 2000; Boroditsky, 2001; Gentner, Imai and Boroditsky, 2002) when people reason about time. These spatial primes can include spatially clear response modes, in which the participant physically moves (Torralbo, Santiago and Lupiáñez, 2006; Weger and Pratt, 2008), or primes based on imagined motion, in which the participant imagines the movement while watching a video for example (Boroditsky and Ramscar, 2002; Matlock et al., 2005).

As can be seen, spatial-temporal metaphors can guide how time is merged with space and processed by the cognitive system (Bonato et al., 2012: 2264). The space-time relationship, as mentioned above, does not flow symmetrically. Spatial reasoning influences temporal reasoning, but temporal reasoning does not influence spatial reasoning. This can be seen in reversed orthography tasks (Casasanto and Bottini, 2014; Fuhrman and Boroditsky 2010; Ouellet, Santiago, Israeli and Gabay, 2010; Tversky, Kugelmass and Winter, 1991), riding the train tasks (Boroditsky and Ramscar, 2002), or training the participants to talk about time using vertical spatial metaphors (Casasanto and Bottini, 2010), in which the reading direction of a text is reversed, the participant is put in a moving-train scenario, or the participant must use vertical metaphors when thinking about time, respectively. In the moving train scenario, the participant watches a video, which depicts a train either moving away or moving towards something. The participant watching the video takes on an ego-moving perspective, which leads to the participant mentally travelling on a train (Casasanto, 2016a:1680; Núñez & Cooperrider, 2013:221; Bender et al., 2012:1; Casasanto & Bottini, 2014:1346). After priming the

participants with these tasks, they are asked to give feedback on the flow of time, in for example a temporal diagram task (in this task, the participant is asked to place the future or the past in one of the empty boxes presented on a blank piece of paper). It has been seen that the conventional flow of time found in their language has either been reversed or manipulated, giving way to cultural flexibility. The asymmetrical space-time relationship is due to space being three-dimensional and giving rise to multiple perspectives. Time, on the other hand, is two-dimensional, moving in a linear motion, from one pole to the other (Bonato et al., 2012: 2258; Casasanto, 2016b:161; Casasanto, 2016b:171; Radden, 2003:226-227; Ouellet, et al., 2009:309; Boroditsky, 2000:8; Evans, 2004:13). Therefore, space can influence how time is perceived, but time has no influence on how space is perceived. Time makes use of a limited set of spatial understandings for it to be experienced (Núñez & Cooperrider, 2013: 221; Boroditsky, 2000:16-17; Haspelmath, 1997:1).

A distinction that is necessary to be made is the difference between time perception and time conceptualisation. Perceiving and tracking time happens universally in nature, occurring separately from time conceptualisation. Concepts like past and future are high-cognition concepts, which are mediated by language and culture, while being presented in bodily experiences (Núñez & Cooperrider, 2013:220).

At this point the question arises, which axis is used when thinking and speaking about time, and which end of the timeline is chosen to represent the future and the past (Radden, 2003:230; Rolke et al., 2013:231; Casasanto, 2016b:170).

Benjamin Lee Whorf (1956) was one of the first to inquire about how time is conceptualised in European languages versus how it is conceptualised in Hopi (1956:151). While the European concept of time was thought of as motion through space, he stated that the Hopi do not have spatial metaphors in general. European languages, with one of them being English, draw on spatial metaphors to make temporal differences (Núñez & Cooperrider, 2013:220-221). Although the Hopi do not have spatial metaphors to make a temporal reference, there were many parallels between English and Hopi with regards to how space is constructed when speaking about time. An example was, when referring to the past in English and Hopi, it was referred to towards the back (Malokti, 1983:87). This leads to the assumption that the space-

time mapping is all about thought and does not only refer to and include linguistic expressions (Núñez & Cooperrider, 2013:221).

2.2.1. Time-space link in nonverbal behaviour

Physical motion scenarios further show the mapping of time onto space in primed parallel construal of time. Speakers, who imagined moving or who have been physically moving were primed to give the Moving-Ego (the perspective where the ego, or the person, moves through time) rather than the Moving-Time (the perspective where the ego, or the person, stands still, and time flows by them) interpretations of English metaphorical time phrases. The phrases that were included in the questions that the participants had to answer were ambiguous in nature and could have been interpreted from either one of these perspectives. They included phrases such as *the meeting was moved forward*. If time in this phrase was interpreted with the Moving-Ego perspective, then the meeting was rescheduled to an earlier time. If it were interpreted in the Moving-Time perspective, then the meeting was rescheduled to a later time. Speakers that *imagined* moving interpreted the phrases through the Moving-Ego perspective, whereas speakers that have been *physically* moving interpreted the phrases through the Moving-Time perspective.

The link between time and space in non-verbal behaviour can be clearly seen in the psychophysics, which branches out from experimental psychology. It is the study of how people can encode, differentiate or replicate physical stimuli, i.e. the length of a line (Casasanto, 2016b; Bylund & Athanasopoulos, 2017). Focusing on the mental representations of time and space, one experiment was developed to investigate their relationship in English speakers (Casasanto,2016b). Participants saw objects that varied in their spatial or temporal degree. Lines of different spatial lengths and durations gradually grew across the computer screen, and then disappeared when they reached their maximum degree in space and time. Participants were then asked to reproduce either the spatial or temporal period, by indicating the beginning and the end on the computer screen. Participants were unable to ignore the spatial dimension when replicating the temporal length. Lines of the same average duration but that travelled a longer distance were judged to have taken a longer time than the ones that travelled a shorter distance, taking a shorter time.

2.2.2. The mental timeline and its construction

Time and space have a tight relationship, in which we move through space from one place to the next. This relationship is universal throughout different contexts. Time can flow on the sagittal axis, it can flow on the vertical axis, or it can flow on the lateral axis.

Speakers of different languages may conceptualize space in the same way yet differ in how they might map time onto space (McNeill, 1992). The difference in conceptualization and mapping time onto space portrays the subjectivity in how speakers of different languages perceive time. Therefore, different speakers may think of time as either moving from the left to right, from the right to left, or moving up and down, for example (Radden, 2003:226). This representation of time as space usually makes use of the spatial layout of a "mental timeline", which can be viewed with the mind's eye. On this, in specific cultures, the past and the future can be viewed as either to the left or to the right. The body of the speaker therefore provides a permanent reference point from which the mental timeline flows (Casasanto & Jasmin, 2012:660).

Time flows on a spatial continuum, which is likened to a line. On this line time flows from one pole to the other, for which one pole is the future, and the other is the past. The orientation of the mental timeline, however, is not the same in all cultures. In other words, the spatial orientation of the mental timeline is culturally mediated (Bonato et al., 2012:2258).

As mentioned above, the mental timeline is a representation of time that refers to spatial characteristics and orientations to represent time (Bonato et al., 2012:2258). The orientation in space can follow the sagittal, the lateral or the vertical axis. Reference of time onto the sagittal axis can be influenced by our experience with motion. This is directed towards the front, and by spatial metaphors in English, in which the future is said to lie ahead and the past behind the ego. This can be seen in English expressions such as *weeks ahead of us*, or *we have left that behind us*. The use of the lateral axis in Western cultures can be explained through multiple ways. It is most likely determined by cultural artefacts, such as graphical representations (like orthography) in Western cultures, in which a left to right direction represents the flow of time (Radden, 2003:228). A parallel that can be seen with the mental timeline is the mental number line, which closely resembles the mental representation for numbers. The abstract concept of numbers is, just like time, spatially represented. The relationship between numbers and space is a close and systematic one, in which the semantic value of a number would be represented

by its spatial location on the mental number line (Ishihara, Keller, Rossetti and Prinz, 2008:455). The mental number line also follows the writing direction, which in Western cultures would represent smaller numbers towards the left and larger numbers towards the right (Bonato et al, 2012:2258-2259).

The similar abstract concept of numbers seems to interact with the representation of time. In studies investigating the time-number relationship, an overestimation of temporal duration when paired with large numbers and an underestimation of temporal duration when paired with small numbers became noticeable (Bonato et al, 2012:2267; Besner & Coltheart, 1979). The relationship between left-right responses concerning duration and spatial position have been investigated in a duration judgement task (Bonato et al, 2012:2259-2260; Conson, Cinque, Barbarulo, & Trojano, 2008), in which participants decided if the first or the second tone represented in pairs was shorter or longer. They had to respond by pressing two lateralized keys. It concluded that responses were faster when short and long durational tones had to be responded to with the left and right keys, respectively. The spatial associations between left-short durations and right-long durations becomes clear here (Bonato et al, 2012:2259; Conson et al., 2008).

The cognitive representations of stimuli such as numbers, letters from the alphabet, and pitch, as seen above, have certain characteristics that influence the speed of manual responses. This can be seen in an experiment by Ishihara, Keller, Rossetti and Prinz (2008:455-457), in which the results showed that faster left-side responses were associated with smaller numbers, and faster right-side responses were associated with larger numbers. This is referred to as the SNARC effect, which stands for the spatial-numerical association of response codes effect (Dehaene, Bossini and Giraux, 1993; Fischer, 2003; Fischer, Castel, Dodd and Pratt., 2003; Gevers, Lammertyn, Notebaert, Verguts and Fias, 2006; Ishihara Jacquin-Courtois, Flory, Salemme, Imanaka and Rossetti, 2006; Ito and Hatta, 2004). This effect suggests that something like the mental number line exists. The same has been found to occur when investigating musical pitch. Spatial information mediates auditory pitch, where responses with the left-hand side are faster in association with lower pitch, and responses with the right-hand side are faster in association with higher pitch. This is referred to as the SMARC effect, which stands for the spatial-musical association of response codes effect (Keller and Koch, 2006; Rusconi et al., 2006). This suggests the existence of a mental timeline, in which the time is represented to be

spatially aligned, from the left towards the right. This is similar to what is seen in the SNARC and SMARC effect, and can be called the STEARC effect, which stands for the spatial-temporal association of response codes effect (Walsh, 2003; Ishihara, Keller, Rossetti and Prinz, 2008:455). An experiment which tested the layout of the mental timeline in German speakers was the auditory click test (Ishihara et al., 2008: 455-457). Participants listened to eight auditory clicks, of which the last click was manipulated. Participants were then asked to listen to the entire sequence and indicate on one of the two horizontally laid out response buttons if the timing of the last click was either earlier or later than expected. The left button was assigned to 'early' and the right to 'late'. In the congruent condition, in which the left button represented 'early' and the right 'late', participants responded quicker in the congruent condition than in the incongruent condition. In the second experiment, the procedure was the same, except that the response buttons were laid out on the vertical axis, on which the upper button represented 'late' and the lower button represented 'early'. In the second experiment, it was found that there was no reliable vertical spatial representation of time found in the participants' responses. When comparing the use of the horizontal and vertical axis, then it becomes clear that the significant difference signals the horizontal axis as being the representative axis for the space-time relation in German speakers (Ishihara et al, 2008: 456-460). Along with reciting the alphabet or other similar serial processes (in Western cultures), speakers mentally move from one symbol to the next, showing the existence of a mental timeline. When specifically looking at the mental number line, one can predict if a person is thinking about smaller or larger numbers, because their eyes move towards that specific direction, i.e. smaller numbers found towards the left and larger numbers found towards the right of the mental number line (Matlock et al., 2011:263).

Regarding the concept of future and past, motion may be associated with these concepts. For example, apparent forward motion can trigger daydreams that are orientated towards the future, where on the other hand backward motion can trigger daydreams that are orientated towards the past (Hartmann & Mast, 2012:1559). When looking at it from the perspective of time, the speaker's body sways more towards the back when thinking about the past, and more towards the front when thinking about the future. The direction of motion can influence the way we reason about time. In the research investigating the influence of body sway when having to categorize visually presented verbal stimuli presented on a head mounted display, it was found that faster response times were recorded when the direction of the body-motion induced by a

motion platform, was in line with the spatial representation of the concept, i.e. the body being displaced forward while a future related verbal stimuli was presented. This can be likened with mental time travel, in which participants are asked to think about either the future or the past and the body sway was recorded. The results were similar, in the sense that future orientated stimuli evoked forward body sway (Hartmann & Mast, 2012:1559-1561; Matlock et al, 2011:261; Miles, Nind and Macrae, 2010).

When looking further at the vertical axis, English speakers could also conceptualise earlier times as being "up" and later times as being "down". This is seen when looking at graphical representations of a family tree. The older generations, also called the *ascendants* are put towards the top and younger generation, also known as the *descendants*, are put towards the bottom. Linguistically, when saying *the myth has been passed down from generation to generation*, a flow of time from the top to bottom becomes clear (Radden, 2003: 228). A flow of time from the bottom up can be found in expressions such as *we are coming up on the deadline* or *the deadline is coming up*. Time in both instances is conceptualised on the vertical axis, but there is no temporal oppositional relationship between *up* and *down*, in which they each represent one pole on the timeline, of which one represents the future and the other the past (Casasanto, 2016b:173).

Having looked at the mental timeline following a line, the space used to conceptualise time can also follow either a partial or a full circle. The linear flow of the mental timeline provides opposite poles on which the future and the past can be placed. The circular mental timeline is not that widely spread amongst languages, but can also be seen linguistically in English, when saying for example, *history repeats itself*, *the centre is open around the clock*, or *the tour is available all year-round*. The 24-hour reference is motivated iconically by the round shape of the clock (Radden, 2003:229-230).

2.2.2.1. Construction of the mental timeline

The mental timeline is a mental model that helps people to comprehend and reason about the abstract concept of time. This type of model is built to solve a problem while also being internally coherent. When such a model is built from, for example, a left to right reading direction, then things are literally mentioned from left to right, with the earlier towards the left and the later towards the right. The mental timeline is motivated by our conceptual experience,

i.e. events that occur earlier are positioned towards the left in the temporal mental space, and later events towards the right (Ouellet, Santiago, Israeli & Gabay, 2010:312-313; Matlock, Holmes, Srinivasan & Ramscar, 2011: 261). Other visual influences and representations of the temporal flow of the mental timeline are, for example, the symbols used for music and video players, which are found in everyday life. We use these to play the audio/video, or to navigate to the specific point which we want to listen to or watch. These buttons are organised according to cultural conventions that suggest the time-space relationship. The buttons are usually marked as 'rewind <<', 'play >' and 'fast-forward >>'. Each arrow represents the direction towards which time presumably flows. This can suggest the existence of a mental timeline, which spatially flows from the left towards the right (Ishihara, Keller, Rossetti & Prinz, 2008:455).

The mental timeline is existent but is also flexible and can be constructed through various means. The directional reading-writing experience from left to right, right to left or top to bottom can also be an influential source for the conceptual mapping of time onto space (Ouellet, Santiago, Israeli & Gabay, 2010:308).

2.2.2.2. Cultural artefacts

In English, for example, spatial metaphors refer the future ahead of the ego and the past towards the back of the ego. This can be explained by movement towards the front, *walking into the future*, and *leaving the past behind us*. The future, however, also lies towards the right and the past towards the left on the lateral axis. The spatial metaphors refer to the sagittal axis, while English speakers gesture on the lateral axis, of which the latter is presumable mediated by orthography. When looking at the placement of the future and the past on the mental timeline, then the past lies towards the left and the future towards the right in most Western cultures, like English. The spatial feature in this matter is associated with time, independent from duration or numbers. The earlier-left and later-right relationship has been tested with a probe stimulus experiment (Ishihara, Keller, Rossetti, & Prinz, 2008:456-457). The onset timing of a short probe stimulus was varied, following intermittent auditory clicks. Participants then had to press either one of the two lateralized response keys. This depended on whether the onset of a given probe either occurred earlier or later than expected, compared to the previous click intervals. Again, in this case, the left key responses were faster for earlier times and the right key responses were faster for later times (Ishihara, Keller, Rossetti, & Prinz, 2008:456-457).

One however needs to also look at languages that differ from the conventional left to right writing direction. In a study by Ouellet, Santiago, Israeli and Gabay (2010), Hebrew and Spanish speakers were asked to distinguish between temporally characterized words, which were presented through auditory means. Spanish speakers showed faster responses for past words with the left response keys, and faster responses for future words with the right response key. Hebrew speakers on the other hand showed the reversed pattern, confirming the writing direction of a given language having an influence on spatial mapping of time on the mental timeline, which is right to left in Hebrew speakers (Bonato et al, 2012:2259-2260). Interestingly, this can be reversed when presenting a task which involves reading a text in reverse. English speakers would then for example read a text from right to left, and Hebrew speakers would read a text from left to right. It follows that visuomotor actions (this refers to when vision (visuo) and movement (motor) work together, in order to produce an action) can affect the cognitive representation of abstract concepts like time. This cognitive flexibility demonstrates that humans' orthography is a reliable influencer when it comes to spatializing and directionalising time on the mental timeline, (Bonato et al, 2012: 2260-2261; Oullet, Santiago, Israeli & Gabay, 2010:312-313).

Cultural artefacts, such as reading and writing direction, graphical representations, and directional flow of a calendar in a certain language, as it has been seen, affects how people of that language lay out time. Further spontaneous temporal co-speech gestures in English have been investigated by Casasanto and Jasmin (2012). They found that these co-speech gestures follow the lateral axis, on which the future is towards the right and the past towards the left-hand side of the speaker. This is consistent with the cultural artefacts and conventions in English and reveals the implied space-time mapping that arises when talking about time (Casasanto & Jasmin, 2012:643-644; Casasanto, 2016b: 173). Another experiment (Ouellet, Santiago, Israeli & Gabay, 2010), that not only provides evidence for the mapping of time in English speakers but compares this to the mapping of time in Arabic speakers, is one in which English-speaking participants had to lay out the order of events, such as meals of the day. These English speakers mapped these out onto a horizontal line with a rightward direction, on which earlier events were towards the left and later events were towards the right. Arabic speakers on the other hand showed the reversed effect, in which earlier events were towards the right and later events were towards the left. Hebrew speakers portrayed the same tendency, yet a little weaker than the

Arabic speakers, also laying out the proceeding of time from right to left, influenced through the writing direction, which flows from right to left. Hebrew speakers, however, have a weaker tendency than Arabic speakers to layout a sequence of events from the right to the left, which could be due to the Hebrew orthography not being a complete right to left system. The words are written and read from right to left, but the individual letters are often written from left to right. This also goes for the number system and musical notations, which both run from left to right in Hebrew (Ouellet, Santiago, Israeli & Gabay, 2010:308). The layout of time and its relationship with the writing direction was tested in the experiment, in which two pictures were presented in temporal order. Participants were then asked if the second picture represented a conceptually earlier or later time-point than the first picture. The participants responded by pressing one of the two buttons assigned for *earlier* and *later*. Both English and Hebrew speakers responded faster when the layout of the response keys was congruent with the writing direction of their native language (for English, left response key for *earlier* and right response key for *later*, and for Hebrew the reversed). From this, they concluded that people automatically use culturally specific relations between space and time. English speakers in this sense therefore responded faster with the left key for earlier events and with the right key for later events. When the experimenter provided a space-time mapping that conflicted with the writing direction of the participant, then the participant experienced interference and their response time was significantly slower (Fuhrman & Boroditsky, 2010:1431; 1436-1440; 1444; Rolke et al, 2013:240).

The cultural specificity of writing direction determining the flow of time in certain languages like English and Hebrew suggests that it also organizes peoples' visual behavior, on which earlier times are towards the left and later times are towards the right in English. This mental timeline is a continuum, which can span from seconds to centuries, depending on the temporal input (Fuhrman & Boroditsky, 2010: 1445; Ouellet, Santiago, Israeli & Gabay, 2010:308). The explanation on why speakers implicitly refer to their native writing direction when thinking about time is because when an English speaker starts reading, for example, then they experience a laterally systematic progress through space and time. They begin reading or writing on the left-hand side and gradually, with their eyes, move towards the right-hand side of the page and arrive there at a later stage (Casasanto, 2016b:178).

There is a cultural flexibility when it comes to the mapping of time onto space and what influences the construction of the mental timeline has (Ouellet, Santiago, Israeli & Gabay, 2010:310). Cultural artefacts such as the reading and writing direction, as seen in English, Hebrew and Arabic, influences that speakers think about time flowing either from the left to the right, in the case of the English speakers, or from the right to the left, in the case of the Hebrew and Arabic speakers. Other cultural influences found are the importance and value put on the past, such as in Darija speakers, and the mere fact that the past is known and therefore can be seen, such as in Aymara speakers.

The influence of cultural artefacts, in this case the writing direction, can further be seen in research done on French speakers and Arabic speakers, whose writing direction differs from each other. The French writing direction flows from left to right, where the Arabic writing direction flows from the right to the left. Between these two languages a space perception asymmetry can be seen (Fagard & Dahmen, 2010: 39-41; 44-48). When participants are asked to bisect a horizontal line, then French speakers place the midpoint more to the left of the true centre, and Arabic speakers place the midpoint more to the right of the true centre. Another non-linguistic task that was used to investigate writing habits and its directional tendencies was the drawing circle task. It was hypothesized that in principle, the start of the circle determines towards what direction the circle will be drawn. In other words, when participants start drawing the circle at the top or on the right-hand side, then they will use a counter clockwise direction. If they start drawing the circle at the bottom towards the left, then they will use a clockwise direction. The general tendency in this exercise therefore is to always go towards the left upper part of the space. In the research done on French speakers and Arabic speakers it was found that French speakers more often used the counter clockwise direction than Arabic speakers, leading to the assumption that speakers of these languages tended to go towards the starting direction of their native reading and writing habits (Fagard & Dahmen, 2010: 39-41; 48-50).

2.2.2.3. Spatial expressions for time in language

Cultural artefacts, however, cannot account for all instances of time mapped onto space. It brings forth the need to look at language as another factor, which will enhance our understanding of how the mental timeline is constructed.

Abstract concepts are comprehended and structured through metaphorical mappings, taken from a small set of experiential concepts. In other words, language from a concrete domain is used to talk about and understand concepts from a more abstract domain. This source-to-target mapping can be seen with the mapping of time onto space in different languages. This is referred to as the Metaphoric Structuring View (Boroditsky, 2000). The main job of the metaphor is to construct a relational structure to an abstract concept by introducing it from a more concrete concept. Relevant to this study, time is organized using spatial metaphors. Through experience, we know how one should reason about time. We know that in time, moments only happen once, we can only physically be in one place at a time, and we can never go back into the past. We also know that aspects of our experiences are not permanent and that our movement in time is unidirectional and continuously changing, and this can be marked by arrival and departure of events or objects. The construed unidimensional movement of time should be, and indeed seems to be, a universal phenomenon found across different language and cultures (Boroditsky, 2000:2-3). For people to be able to think and speak about events, time is conceived as a directional, one-dimensional entity. When looking at the dimensions in which time is referred to, English tends to refer to time on a unidimensional spatial length, e.g. short time, short rope. This unidimensional spatial mapping has been said to be universal. The representation of a unidirectional flow of time, where "time's arrow neither stands still nor reverses. It merely marches forward" could explain the unidirectional flow of time (Joseph Sugarman, Bojack Horseman, season 4: episode 11). The unidimensional aspect of space can be seen in the experiments done with English and Greek speakers. Greek speakers tend to refer to volume when speaking about temporal duration (e.g. a lot of time in Greek: poli ora). In English, one would say "a long night", where Greek speakers would rather say "a big night" (tr. megali nychta). Although English speakers and Greek speakers have their tendencies when talking about time, the question arises if the way they talk about time can influence the way they think about it. This has been tested in one of the experiments given to English and Greek speakers Casasanto, 2016b), in which one pair of non-linguistic psychophysical tests tested their ability to judge duration in the presence of irrelevant length or volume information. In the length interference task, participants were asked to replicate the lines' durations, while trying to ignore its spatial lengths. In the volume interference task, participants were asked to replicate the durations of a container filling up, while trying to ignore the container's fullness. Resulting,

English speakers had no problem ignoring volume information, while Greek showed the opposite pattern.

A cross-linguistic comparison between English and Greek speakers shows a correlation between temporal language and temporal thinking (Casasanto, 2016b). This was done in an experiment in which English speakers were trained to use volume metaphors for time. It was seen then, that irrelevant volume information influenced English speakers, which was statistically indistinguishable from the statistics found in Greek speakers. From this it is seen, that people that use different temporal metaphors could conceptualise time the way they talk about it. Linguistic experience alone plays an important role in the mental shaping of time, which was seen in the experiment in which English speakers were trained to think about time like Greek speakers (Casasanto, 2016a:160-162).

Linguistically, when speaking about time, metaphors are also one-dimensional, in a sense that the three-dimensionality of space is not utilised when speaking about time. For example, one would talk about (the flow of) time being *ahead* or *behind*, *up* or *down*. However, one would not refer to multi-dimensional metaphors such as *shallow* or *deep*, *left* or *right*. Spatial schemas brought upon by these metaphors offer the relational information that is needed to organise events in time. Language therefore helps us to understand how we move through time, i.e. if we move through it, if time moves past us, towards what direction and on what axis it flows? (Boroditsky, 2000:2-5; Rolke et al., 2013:232-233; Boroditsky, 2011:427; Matlock et al, 2011:261; Oullet et al, 2010:308-309).

In English, notions of time are expressed with a three-way distinction, with the various dimensionalities referring to temporal dimensions: the zero-dimensional *at* is applied for referring to moments in time, such as in *at this moment*. The two-dimensional *on* is used when referring to periods of time, such as in *on my birthday*, and the three-dimensional *in* and *within* is applied when referring to periods of times. German, for example, makes a distinction only on two dimensions: A one-dimensional *an* and a three-dimensional *in*. The one-dimensional reference is applied to certain periods of time, such as *an meinem Geburtstag* “on my birthday” and the three-dimensional *in* covers not only moments in time, such as *in diesem Augenblick* “in this moment”, but also periods in time as in *in einer Woche* “in one week”. The two-dimensionality in German does not exist, in which *auf* “on” is not used in its temporal sense,

like English does. It shows that cross-linguistic variability exists and is the ruler of how time is mapped onto space. A point in time is zero-dimensional, and a duration is one-dimensional and can be described as presenting a "long" or "short" length. A period can be either two-dimensional or three-dimensional, as in *a stretch of two months* which depicts a duration of time, or as in *They worked together for a span of two month*, which depicts a "span" of time (Radden, 2003: 227-228; Casasanto: 2016b:170).

Different languages, however, make use of space differently when referring to time, hence it should also vary their conceptualisation of time (Bender et al., 2012:1). English, for example makes use of the horizontal spatial-temporal metaphors, where Chinese speakers make use of the vertical spatial-temporal metaphors, in which the future is above, and the past is below. In English, *looking ahead* or *looking back* refers time onto the horizontal axis. Chinese native speakers, on the other hand, make use of the vertical axis, when thinking and speaking about time. When referring to the past or earlier times, then they refer to *shang* "up", as in *shànyuè* "up.month", meaning 'last month'. When speaking about later times, then they refer to *xia* "down", as in *xiàyuè* "down.month", meaning 'next month'.

The usage of the vertical axis in time construal was tested amongst Mandarin Chinese participants (Hong, He, Tillman, Zhao & Deng, 2017). Participants were asked three questions about time, in which an experimenter stood directly in front of the participant, pointed to a spot in space, and asked the participant if that spot were to be "today", where would the participant put "yesterday"? When the participant answered by pointing to a certain spot, then the experimenter further asked where the participant would put "tomorrow". Participants were then asked to place "yesterday" and "tomorrow" with respect to "today", "breakfast" and "dinner" with respect to "lunch", or "September" and "October" with respect to "August". No spatial language was used during testing in order not to prime the participants. Overall, Mandarin Chinese speakers predominantly referred to the vertical axis when placing the different temporal points in time. The reference to the vertical axis when speaking about time mirrors time flowing like a river. This is said to be influenced by the significant Yangtze River, which is the longest river in Asia, and the third longest on the world. In addition, when looking back onto old Chinese literature, it becomes clear that the movement of the sun could also influence the temporal reference on the vertical axis. (Hong, He, Tillman, Zhao & Deng, 2017:1680-1689; Radden, 2003: 228; Boroditsky, 2011:427-429; Haspelmath, 1997:21-22). This

divergence of temporal expressions alone in these two examples show what influence the perception of the world has on meaning making and vice versa. (Haspelmath, 1997:22; Levinson, 2003:75).

Aymara, an Amerindian language, displays a similar pattern when it comes to construing time. When the Aymara speak and think about the future, the word *qhipa* is not only an expression for "future" but is also a basic expression for "back/behind". *Q'ipi uru* literally translated means "back day" but carries the meaning 'the day at my back'. The same goes for when referring to the past. *Nayra* is used when speaking about the past but is also an expression used for "front/eye/sight". *Nayra timpu* literally translated means "eye time" but carries the meaning of 'the time before my eyes'. It could be taken from this, that this lexical data is evidence for the cognitive construction in Aymara speakers (Núñez & Sweetser, 2006: 402-403; de la Fuente et al., 2014:1682). The reasoning behind the temporal-spatial mapping in Aymara follows the metaphor 'Knowledge is Vision'. Things behind the ego cannot be seen and are therefore unknown. Things ahead of the ego can be seen and are therefore known. Hence, the future lies behind and the past in front of the ego (Núñez & Sweetser, 2006: 414-419; 438-440; Radden, 2003:230-231; Fuhrman & Boroditsky, 2010:1431). The section 2.2.3 Temporal thought revealed by gesture, will delve deeper into the Aymara language and the reasoning for the mapping of time onto space revealed through gestures, while also looking further at English, and other languages differing from Western cultures.

When looking at ambiguity, in for example English, the placement of the future and the past can be quite unclear at times, in which one might think that the future lies behind and the past ahead of the speaker. For example, everyone knows that *Christmas follows Thanksgiving*, or that *Christmas comes after Thanksgiving*. The literal meaning of these two examples are that Christmas occurs later than Thanksgiving in the year. When using *follow* and *comes after* it implies a meaning of being behind something, because the follower is someone or something behind the followed. One might therefore claim that English is another language in which the future lies behind. The question arises "behind what?" When saying for example *Christmas is behind us* or *Christmas is following us*, it does not mean that Christmas is in the future relative to the speaker's now. It means that Christmas is in the speaker's past. Another ambiguous example is *ahead of time*. This means "earlier than". The relation in what is ahead is that one time is ahead of another time, not relating to any speaker's now. Saying something like *ahead*

of us therefore means that something is “later than the present”, and not “earlier than the present”. This is where the ambiguity comes in and English could be mistaken for a past in front language (Núñez & Sweetser, 2006: 403-404).

Another famous ambiguous sentence is *Next Wednesday’s meeting has been moved forward two days*. The question arises to what day has the meeting moved to? This depends on what temporal frame of reference the speaker takes on. If the Moving Ego perspective is adopted, then the speaker moves towards the future and leaves the past behind them, therefore the meeting would have seemed to move to Friday. If the Moving Time perspective were adopted, then future events approach the Ego and passes it by, therefore the meeting would have seemed to move to Monday. These perspectives can be primed either through spatial or temporal means (Bender et al., 2012:2; Matlock et al, 2011:262). Temporal thought revealed by gesture

As seen in the previous sections, why studies decide to look at gestures, more specifically temporal gestures, is because studying speech alone is not enough to understand mental representations. In this section, English and further not so known languages will be discussed.

Casasanto and Jasmin (2012) conducted a further study which investigated co-speech gestures in English speakers. It involved separate experiments for deliberate and spontaneous gestures, to show the implicit lateral temporal timeline. The idea behind this was to find out, when participants were asked deliberately, if language had a higher impact on how participants would anchor their gestures onto the axis. In other words, spatio-temporal metaphors flow along the sagittal axis, on which the future lies towards the front and the past towards the back (Casasanto and Jasmin, 2010:643). In the first experiment, 32 English speakers volunteered to take part in a short experiment, eliciting deliberate gestures. The material used, were four pairs of questions, which asked about events happening either in the past or in the future. Each participant was asked one pair of question. Overall, one pair of questions used deictic reference, and the other pair used sequence reference. Half of these questions used directional language and the other half used non-directional language. After executing this experiment, Casasanto and Jasmin (2012) found, that 42% of the overall gestures were anchored onto the lateral axis, and 58% were anchored onto the sagittal axis. The gestures that were anchored onto the lateral axis were congruent with the cultural conventions, such as the flow of graphs, and the gestures anchored onto the sagittal axis were congruent with the spatio-temporal metaphors found in English. The

highest congruency overall was found in the deictic temporal reference, in which participants anchored their gestures onto the sagittal axis, on which the future was towards the front and the past towards the back. This can lead to the assumption, that deictic temporal language mediates the mapping of time onto space onto the sagittal axis, and therefore participants gesture accordingly. Regarding this first experiment, Casasanto and Jasmin (2012) assume, that the data collected offers little support for the proposal that people think and speak about time in the same frame (Casasanto & Jasmin, 2012: 652).

In Casasanto and Jasmin's (2012) second experiment, spontaneous co-speech gestures were investigated. In total, 28 English speakers were recruited. For this experiment, four short stories were constructed, of which two had a pastward narrative and two had a futureward narrative. Half of these stories used a deictic temporal reference and the other half used a sequence temporal reference. Two versions of each story were created, of which one version used spatio-temporal metaphors, and the other version used non-spatial metaphors. In order to elicit spontaneous gestures, and the participants would not know that their gestures were of interest, they were told that the experiment was about storytelling. The participants were given time to read through the stories and then recite them to their partner, with whom they are executing the experiment with. The results of this experiment showed that 74% of the overall temporal gestures were anchored onto the lateral axis, and 26% of the temporal gestures were anchored onto the sagittal axis. The higher use of the lateral axis to anchor the temporal gestures is most likely influenced by participants having been exposed to the instructions in written form, therefore the cultural artefact, such as the directional flow of orthography, having an influence on how participants anchored their gestures (Casasanto & Jasmin, 2012:654-656).

This left-right mapping of time onto space coincides with the flow of time of cultural artefacts, such as the reading and writing direction, or the directional flow of graphs and calendars, is, however, absent from spoken metaphors in English (Casasanto and Jasmin, 2010:643) English speakers' tendencies to use the lateral axis when speaking about time can be explained further, that the usage of the lateral axis regarding co-speech gestures could be a pragmatic, kinematic and a mnemonic explanation. Pragmatically, speakers could refer to the lateral axis, because it carries with it a bigger information value. When in discourse, the change in depth on the sagittal axis is more difficult for an interlocutor to visually perceive. Movements on the lateral axis improve the visibility of gestures, which with it can convey more information for the same

amount of gestures. The kinematics of lateral hand gestures is that the reach of one's hand movements extends about twice as far on the lateral axis than on the sagittal axis. This makes it possible to portray more discriminable points on the axis. Furthermore, although the sagittal and lateral axis both have oppositional poles, the ones on the lateral axis are more motorically available. This becomes clear when wanting to discriminate between one time point in the past, and then another earlier time point in the past, which lies even further towards the left. The mnemonic reason for the usage of the lateral axis is the easiness of the visualisation of the timeline with the mind's eye. To view the past or the future, the imaginer only needs to turn the mind's eye towards the left or right. If they would need to visualise the past on the sagittal axis, then they would need to turn around about 180 degrees, or even better, have a second pair of eyes at the back of the head (Casasanto & Jasmin, 2012:659-660; Casasanto, 2016b:179-180).

Overall, in the study done by Casasanto and Jasmin (2012), the main focus was on which axis the participants refer to when anchoring their temporal gestures. There was no further report done on specifically the left and right hand, if any other body parts were used to gesture about time, or how the distribution of hand dominance amongst participants looked like. This is where Cooperrider and Núñez's (2009) study took it one step further by also including head and foot points.

Cooperrider and Núñez's (2009) investigated temporal gestures amongst American English speakers, in which time is assumed to be conceptualised flowing from the left towards the right. The material used for this study was an image depicting the history of the universe. This alleviated the priming of the flow of the text, which is from the left to the right, priming the participant to anchor their temporal gestures onto the lateral axis. On the left-hand side of this poster, the big bang was depicted, and on the right-hand side, a satellite in space was depicted. In between these two images, major events that occurred throughout human life were presented. The procedure of this experiment was that the first participant was presented with the graph, and then had to retell the graph to the second participant, who entered the room a while later. The second participants then, after having listened to the story, had to retell the story to the third participant, who entered the room after participant one and two were done talking.

Overall, 50 participants took part, of which all were English first language speakers, and the majority of their gestures produced fell onto the lateral axis (Cooperrider & Núñez, 2009:186-

188). Cooperrider and Núñez (2009) not only investigated what axis was used to anchor the temporal gestures, but also what types of temporal gestures were produced. In other words, five types of temporal gestures were reported on. This division between the gestures gave a deeper insight into the mental content that is not visible for the researcher (Cooperrider & Núñez, 2009:188). The five types of gestures that Cooperrider and Núñez (2009) reported on were placing, pointing, duration-marking, bridging, and animating (Cooperrider & Núñez, 2009:181). A placing gesture was a gesture that located a named event in space, where a pointing gesture would be a participant pointing to an event or time as if they have a concrete visible location in space (Cooperrider & Núñez, 2009:188-192). Duration-marking gesture types expressed temporal length between two events, or the duration of one event (Cooperrider & Núñez, 2009:192). The bridging gesture type is used when having to express a transition between two events. These gestures are usually co-produced with co-speech expressions such as "after that" or "later" for example (Cooperrider & Núñez, 2009:196). Lastly, animating temporal gesture types are the ones which are co-produced with the word "time". This gesture type is produced by the hand enacting the idea of time presented with motion on its own (Cooperrider & Núñez, 2009:196). Concluding from the in-depth analysis done by Cooperrider and Núñez (2009), it becomes clear that temporal reasoning goes hand-in-hand with temporal gestures, and therefore an insight into mental representations and understanding of time. Temporal gestures produced by English speakers is said to be influenced by shared knowledge about how time is conceptualised. It is not random, but systematically organised and related to speech it accompanies (Cooperrider & Núñez, 2009:203).

The laterality of English speakers' timeline was furthermore tested in an experiment in which participants had to decide either if the celebrity became famous before or after the participant was born. The participants responded by pressing a button either on the left or on the right side of the keyboard. In the first half of the experiment, the left button represented "before", and the right button represented "after", and in the second half of the experiment, the order was reversed. Responses with the key mapping found in the first half of the experiment was faster than in the second half of the experiment (Casasanto, 2016b:174), leading to the assumption that an organised mental timeline in English speakers exists, on which the past is towards the left and the future towards the right.

Speakers of English and Darija, of which the latter is a dialect of Moroccan Arabic, share similarities in the usage of spatial metaphors, but differ in the temporal gesticulations (Casasanto, 2016b:169; 183). Both languages map the future ahead and the past behind when talking about time with conventional metaphors. English speakers, however, gesture towards the right for the future and towards the left for the past (Casasanto, 2016b:170-174; Bonato et al, 2012: 2258; Fuhrman & Boroditsky, 2010:1436, 1446; Ouellet, Santiago, Israeli & Gabay, 2009:308; Rolke et al., 2013:232; de la Fuente et al, 2014:1682). Darija speakers, on the other hand, gesture towards the front for the past and towards the back for the future. In these cases, English speakers are influenced by direction of their cultural artefacts (i.e. left to right reading and writing direction, flow of time on calendars and graphs), whereas Darija speakers are influenced by their cultural conventions to focus on the past (i.e. valuing their ancestors and practicing ancient traditions), contradicting the verbal future-in-front metaphors (Casasanto, 2016b:170-171; 178-179, 184; Casasanto & Jasmin, 2012:647-649; de la Fuente et al, 2014:1682-1683; Casasanto & Bottini, 2014:1342).

Co-speech gestures reveal an implicit conceptualisation of time in English and Darija speakers, which cannot be inferred from language (Casasanto, 2016b:170). English speakers on the one hand think about time with regards to the lateral axis, because they are informed by their spatial experiences (Casasanto, 2016b:176). When regarding Darija speakers, an individual's attitude towards time plays the determining role in positioning the future and the past (de la Fuente, et al., 2014:1682; 1688-1689; Casasanto, 2016b:181-182). The seniors who still speak Aymara have informally learnt Spanish in their teen years. The video-recorded interviews were informal and lasted about 20 to 50 minutes. The interviews were grouped into two parts, which all revolved around time. The first part asked about future and past events, in which participants could talk, comment, compare and explain a series of events. In the second part, participants were asked to talk about traditional anecdotes and expressions involving time. These experiments revealed the importance of the 'Knowledge is Vision' metaphor, in which Aymara speakers made a distinct correlation between vision and knowledge, therefore placing the known towards the front, in line with the eyesight, and the unknown towards the back. This is contradictory to English speakers, and most speakers of the world, in which the known is towards the back behind the ego, and the unknown is towards the front. This differentiation between the bodily orientations is consistent with the bodily experience of the speaker, and on

what their temporal metaphors are based (Núñez & Sweetser, 2006:437-438; Ouellet, Santiago, Israeli & Gabay, 2010:309). The positioning of the spatial representation of time in Pormpuraaw for example, an Australian Aboriginal culture, is shaped by fundamental directions, in which (as mentioned above) the past or earlier times lie towards the East and the future or later times lie towards the West. This refers to the geocentric spatial reference (Bonato et al, 2012:2260).

Looking at the Darija speakers' placement of the future and the past and how these compared with native Spanish speakers' placement of the future and the past in a temporal diagram task, further evidence is made on how temporal thought is made visible through temporal gestures. This was investigated in order to see if both languages do put the past in front. The temporal diagram task was made up of a bird-looking man centred in the middle of the page, looking up towards the top of the page, with an empty box above and an empty box below the man. The image was drawn from a bird's eye view. Participants then read a text which explained that yesterday, a person visited a friend who liked plants and tomorrow that person will visit a friend that likes animals. The participant then had to put the letter P for "plant" corresponding to past events and the letter A for "animal" corresponding with future events in one of the boxes either below or above the man on the diagram. Spanish and Darija were chosen to be compared with each other because both have future in front spatial metaphors, but the Darija speakers gesture the past in front. The results from the temporal diagram task showed that the Darija speakers showed a strong tendency to place the past above the man, while the Spanish showed a strong tendency to place the future above the man (de la Fuente et al, 2014:1683-1684).

Furthermore, as far as research has found, the Yucatec Maya are the only ones that do not make use of temporal mappings onto any of the horizontal locations. They rather point to the ground for the here and now and point towards the sky when speaking about the past or future. The Aymara base their past-to-front mapping onto the 'Knowledge is Vision' metaphor. The Amazonian Amondawa furthermore completely lack the space-time mappings, on the behavioral and linguistic level, for example. It can be concluded, that not all attributes of time are mapped onto space, and that some languages may stay away from relating their temporal conceptions onto their spatial conceptions. More on this can be read up in the following paragraphs (Bender et al., 2012:2; Fuhrman & Boroditsky, 2010:1431; de la Fuente et al, 2014:1682).

The Toba, for example, combine the idea of the past being visible with the cyclic flow of time. Their conceptualisation of time moves in a counter-clockwise circle, in which time flows from the speaker's view towards the recent past, then moves out of the speaker's view into the remote past, which lies opposite the present. At this point, it also merges with the remote future. Time then flows further and approaches the speaker from behind and becomes the immediate future and flows into the present time (Radden, 2003:230-231).

This boils down to what frame of reference a culture uses to map time onto space. This organized system is required to define the relationship between objects from a given viewpoint. Different languages use different frames of reference (Bender, Rothe-Wulf, Hüther & Beller, 2012:1). A portion of speakers of aboriginal Australian languages, such as Pormpuraaw, make use of an absolute frame of reference, in which the past or earlier times lie towards the East and the future or later times lie towards the West. This refers to the geocentric spatial reference. This has been observed in a study in which speakers of Pormpuraaw took part in a card arrangement task. (Núñez & Cooperrider, 2013:225; Bender et al., 2012:1). Another example of a different yet still absolute frame of reference, which also falls under the geocentric orientated spatial reference category, is the one of the Yupno speakers of Papua New Guinea. They make a robust connection between the present moment *now* and the spatial deictic center *here*, which in other words recruits an allocentric spatial contrast for time. The contrasts in this case do not come from the asymmetries of the body where there is a front and back, but rather from asymmetries in the environment, in which they refer to the uphill and downhill movement. When describing temporal and spatial events, they use uphill gestures when speaking about the future and downhill gestures when speaking about the past (Núñez & Cooperrider, 2013:223-226; Bender et al., 2012:1).

3. Theoretical Framework

The topic of the current thesis, temporal gesture, rests on a number of theoretical components. These are, first of all, the concept of gesture, second, the nature of abstract concepts, third, the notion that cognitive processes are shaped by different experiential factors, and lastly, specific concepts of time. In what follows, it will be explained, what gestures are, and that they are a naturally occurring phenomenon amongst humans across the globe. The section on gestures will then be followed by an explanation and discussion of abstract and concrete concepts, which entail the look on the Conceptual Metaphor Theory, the Metaphoric Structuring View, and the Hierarchical Mental Metaphors Theory. The experiential factors that have an influence on cognitive processes are divided into the linguistic factors, the cultural factors and the bodily factors. These different divisions will give an insight into the factors, how and why they influence the way we make sense of the world. The last theoretical component will speak about what perspective the ego (speaker) can take when thinking about time and its movement.

3.1. Gestures

When talking about gestures, then multiple types of communicative movements are included, with the focus usually lying on the hands and the arms. Gestures accompany language and can therefore be seen as one system (McNeill, 2006:2). Language, in this sense, does not mean speech, because gestures can occur without speech, or something being said, but it can still be accompanied by a gesture. For example, when one would utter the phrase “I used the [blank] to clean my backyard”, then the person is looking for the word that is missing in the *[blank]* space. What is most likely to occur, is that the person is looking for the word “broom” and will use their hands to produce a sweeping motion, while pretending to hold a broom. Therefore, language still took part in the production of gesture, even if in that specific instance, speech, or a specific word was not produced. A gesture, however, does not have to be only produced with the hands and arms, as people usually think. It can also be produced with the head, in which the head can take over as a third hand. This can occur in for example, when one would say “We went back to the beach the other day”, in which the head could move towards the left, a little to the back, when uttering the word “back”. The head can be utilised when the hands are otherwise occupied, or it can accompany hand gestures (McNeill, 2006:1). Another body part that can be used to gesture with, are the legs and feet. Again, they can be used when the hands are otherwise

occupied (McNeill, 2006:1-2), and can point towards a specific direction to indicate time (future/past), an object or an event, for example.

Gestures, in general, accompanying speech is a universal occurrence. One of the most fascinating occurrences of gestures is with the congenitally blind speakers. These types of speakers have never in their life observed another human being using gestures, nonetheless, they use gestures no less than sighted humans. They even use gestures when they know they are talking to another blind person. This is evidential for the strong speech-gesture bond (McNeill, 2006:5).

When taking into consideration the circumstance of a gesture, then one sees it together with the part of the world in which it appears. Communication overall does not occur in a vacuum. In other words, gestures take place in the concrete world and cannot be understood outside of these circumstances. Gestures can only be understood in relation to the normative properties of the objects towards which they are directed. The meaning of a gesture can be a function of either the gesture itself, in which the gesture takes on a symbolic character, a concrete object or situation which involves the gesture, or the conditions of the gestures which are directly linked to the specific object use. These different circumstances influencing the use and meaning of a gesture bring forth the pragmatic structure of the object, coming from the relationship between gesture, object and environments. Overall, gestures are cultural products, which help to indicate the world around them, which is also culturally influenced. Therefore, context must be considered when trying to comprehend their meaning (Rodríguez, 2009:292-293).

Firstly, the significance of a gesture will be defined, which gives insight into mental representations. This will give an understanding of why gestures exist, before moving onto the types of gestures and the phases they go through, to become the meaningful motion that is defined as a gesture. This segment of the synchronicity between speech and gesture is called a growth point (Kendon, 2004).

3.1.1. Types of gestures

When looking at gestures alone, then one can make distinctions running along a continuum (Kendon, 2004; McNeill, 2006). For the sake of the current topic, only gesticulations will be discussed. A gesticulation is an embodied meaning relatable to the complementary speech

portrayed through motion. Amongst gestures, gesticulation is the most frequently used type of gesture that covers a broad variants and usages (McNeill, 2006: 2). Gesticulations are produced with, but not restricted to, the arms and hands. The head can sometimes take on the role of a third hand, if the hands are not being used, or are used in another action. Legs and feet can also take over the role of the hands when it comes to gesticulation. The stroke phase of gesticulation is synchronous with the co-produced speech to about 90% of the time. When strokes do appear to be asynchronous to co-produced speech, then they will slightly precede speech to which they semantically link. This usually occurs due to hesitations. Gesticulation rarely, close to never, follows the speech to which it is semantically linked. Controversies regarding gesticulation have arisen, whether it is communicative (produced for the listeners), or if it is helpful mainly for speech production (produced for the speaker) (McNeill, 2006:2). Although gesticulations can combine general and language-specific structures, there are also many differences which can be traced back to the characteristics of the language to which the gestures co-occur.

In gesture types, speech-frame gestures form part of the sentence itself and are lodged in an explicit space in the sentence. For example, “The ball went [gesture of object flying out sideways]”. In this example, the gesture fills in the missing slot that the speaker cannot find the word for, and therefore completes the sentence structure (McNeill, 2006:1-2).

Emblems also fall under the umbrella term of gesture types and are signs that have been conventionalised and usually have historical roots. Famous examples are the thumbs-up or the “OK” sign, which is made up of the index finger touching the tip of the thumb, making a circle, and the three last fingers extended. These gestures are also referred to as quotable gestures. They are culturally specific, have standardised forms and vary from place to place. These types of gestures are meaningful without verbal speech and can occur serially or simultaneously with gestures of other kinds. Some emblematic gestures go way back to the Roman times, in which even Julius Caesar would understand the meaning of the infamous ‘finger’ (Kendon, 2004; McNeill, 2006:2-3).

Pantomime encloses the act of a sequence of gestures that portray a narrative line that tells a story. Pantomimes are produced without speech (McNeill, 2006:3).

3.1.2. Gesture types

In addition, to the different gesture types, there are classification dimensions that refer to gesticulations and speech-framed gestures found on Kendon's Continuum (McNeill, 2006:4), distinguishing different kinds of gestures. These dimensions are made up of the iconic gestures, metaphoric gestures, deictic gestures and beat gestures. Iconic gestures are used when a speaker wants to present an image of a concrete object or action. For example, giving the impression to rip papers in half while saying "and he tore the contract up". Metaphoric gestures on the other hand are not limited to depictions of tangible events but can also depict abstract things that can be imagined. For example, a speaker can pretend to hold an object, as if he or she were presenting it. The meaning behind it, however, is not the presentation of an object, but rather the presentation of an idea (Núñez & Sweetser, 2006:420). When looking at deictic gestures, the most common incidence is the pointing of the index finger. Deictic gestures can, however, be made with any extendable body part or any held object. This is usually used in the aid of locating entities or actions in space (McNeill, 2006:4). Lastly, beat gestures are recognisable as flicks of the hands, either up and down, towards the back and the front, focusing rhythmically on the prosodic high-points of speech. Beats are usually combined with pointing and various iconic gestures (McNeill, 2006:4-5).

3.1.3. Phases of a gesture

While having discussed the different types and dimensions of gesticulations, one must also look at the phase of a gesture, i.e. how a motion turns into a meaningful gesticulation. A gesture is comprised out of various steps that make up the complete gesture phrase. A gesture phrase can consist of up to five phases, which follow in sequence. The preparation phase is when the limb moves away from the resting position and into the actual gesture space, in which the stroke of the gesture begins. The stroke is an obligatory phase, in which the gesture phase with the intended meaning takes place. After the stroke is executed, the optional retraction phase begins, in which the hand or limb can return to its resting position. Lastly, there can be a pre- and post-stroke hold phase, in which a temporary termination of the gesture can occur (McNeill, 2006:7).

3.1.4. Speech-gesture synchrony and co-expressivity

The growth point, is thought to be the earliest phase of a conceptualisation. The growth point describes the unit that combines images and linguistic categorical content. As Vygotsky (1987)

explains in his theory, the growth point represents the minimal psychological unit. The minimal psychological unit in this case is something that holds the important properties of a whole. Regarding this in the linguistic genre, the important properties of a whole are the properties of an image and a linguistic meaning category. In other words, the defining properties of an image, that is being referred to through speech and gesture, are properties that will for example differentiate a bird from a cow, or a humming bird from a sparrow. There are defining properties to a specific image that will differentiate it from other images. The linguistic meaning category is the language that we use to specify that image and its properties, while also conceptualising it and making sense of it (McNeill, 1992:108-113). This process of the important properties of a whole are made up of the properties of an image and a linguistic category becomes visible in the speech-gesture phase. The image gives the context in the same moment as the utterance occurs while the content in the linguistic category locates this image and its context within the linguistic system that is socially established. In gesture studies, the gesture's semantic content and how it is synchronised with speech, is used to deduce the growth point (McNeill & Duncan, 1998). This can be made clear in the following example taken from McNeill (1992:121):

"Tweety Bird runs and gets a bowling ball and drops *it down* the drainpipe"

The growth point in the example above is found in the image and the synchronous linguistic categorical content. The gesture that was made at *it down* were two hands that formed a big round object and then moved downward. The image in this example was the cartoon character Tweety Bird dropping the bowling ball down. The categorical content in that phrase were the linguistic segment *it* and *down*. The gesture that is co-produced with the sentence represents visuo-spatial thinking, in which the part of the gesture that moves down, representing the ball moving down, was an action of an agent and central to the gesture-speech phase (McNeill, 1992:108-109). The linguistic categories are therefore grounded, through this imagery, in a specific visuo-spatial context. In other words, the gesture that produced the downward movement is a specific visualisation of the general linguistic category *down* (McNeill, 1992:123-124; McNeill and Duncan, 1998).

Growth points with opposing ideas of image on the one side and language category on the other, are both equally crucial to thinking-for-speaking (which will be discusses in 3.3.1). The opposition between the image and the language category is said to be key to unlocking speech.

The interaction between the image and language leads to them influencing each other creating a continuous back-and-forth flow. The mutual influence of image and language, in other words, influence each other, enabling the utterance to unfold in real-time. Speech therefore is not a translation of one medium into another medium, which would be a translation from image to language. The growth point, that has the imagery and linguistic interaction, is therefore the mediating link between the cognition of an individual and the language system (McNeill and Duncan, 1998).

3.2. Abstract and Concrete Concepts

A concept can be defined through various theories, that all cover a different aspect of what defines a concept. Some of these definitions revolve around concepts making it possible for people to categorise information fast, execute analytic inference or the concept's compositionality. Concepts can draw their defining characteristics from the physical world, they can be related to other concepts from which they take on some of their characteristics, and they can form as a constitutive of another concept (Laurence and Margolis, 1999: 71-73). Concepts have a linguistic meaning while also being culturally influenced. It is not just a word, but a piece of information that helps human beings understand the world around them, while also shaping the way people comprehend their reality. However, not all concepts can be grasped with bare hands Some are concrete, like *bread* and *butter*, and some are abstract, like *love* and *liberty*. The concepts of interest to this section, namely the abstract concepts, will be discussed below, including how they come to be and how they stay in our daily usage when thinking and speaking.

3.2.1. Conceptual Metaphor Theory

To explain this further, Lakoff and Johnson (1980) introduce the conceptual metaphor theory, which gives a nice and simplistic example that could be easily related to. The concept of *argument*, and it being related to *war*. In this example, an abstract concept (*argument*) is related to a concrete concept (*war*), to make sense of it and give it a deeper, more thorough connotation (Lakoff and Johnson, 1980:5). To clarify, the difference between a concrete and an abstract concept, is that a concrete concept has physical referents and an abstract concept does not. In the example given above, the phrase can, and is, usually used as *argument is war*. With this

conceptual metaphor in place, relatable expressions, taken from Lakoff and Johnson (1980:5) can be said:

I *demolished* his argument,

You disagree? Okay, *shoot*!

He *attacked* every weak point in my argument. His criticisms were right *on target*.

The italicized words, are the words that relate the concept of *war* to the concept of *argument*, feeding back the connotation that comes from *war* to the concept of *argument*. It becomes clear that an argument is therefore not just a conversation, but it is a discussion that can be won or lost, in which the other person is the opponent. That opponent's position is attacked, while we try to defend our own, just like in war. Therefore, what is done in an argument is organized by the concept of war. An argument is a verbal battle. The concepts, however, are relatable in certain cultures, but is not universal. In other words, the concept of argument, can be related to the concept of dance, and therefore the meaning of an argument changes (Lakoff and Johnson, 1980:5). This is influenced through culture, and how they use their language to make sense of the world. In a culture in which an argument is a dance, the process of the argument would go more smoothly and completely different to our type of argument that is related to war. While their goal would be to try and give an aesthetically pleasing performance, we would try to demolish our opponent. Therefore, from our point of view, we would find their relation of an argument to the concept of dance not to be an argument at all. Therefore, as Lakoff and Johnson (1980) put it nicely, "The essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lakoff and Johnson, 1980:6).

The domain of time is no exception, and to represent and talk about time, we often use space (Bonato, Zorzi & Umiltá, 2012:2264-2265; Fuhrman & Boroditsky, 2010:1430; Rolke, Fernández, Schmid, Walker, Lachmair, López, Hervás & Vázquez, 2013:232). Time is represented on graphs, calendars, clocks and hourglasses, and is thus mapped onto space in our environment. When speaking about time, speakers of certain languages, such as English, use spatial metaphors (such as moving a meeting forward or looking back into the past). Likewise, when speakers use gestures to represent temporal sequences, then they might move their hand towards the front when speaking about the meeting moving forward, which would move the

meeting towards the future, or move their hand towards the back, when speaking about looking into the past, when looking at English.

The conceptual metaphor theory is a precursor to the metaphoric structuring view explained below. It was established by Lakoff and Johnson (1980) and suggests that metaphors are present in every form of language, not only found in literature, but also in everyday living and human thought processes. They are used so casually, that people do not even realise that these are metaphors. A few common ones that are found in daily conversations are *exploding with anger*, *defending a theory*, *fire in her eyes*, *warm personality*, *disgusting idea*, in which the underlined words are the ones implying the metaphoric meaning in the phrase. These metaphors that are found in discourse belong to a specific conceptual metaphor. A conceptual metaphor, in this sense, is an organized mapping between two fields of experience. This, in other words, explains the idea of understanding one domain, the target domain (abstract concepts) in terms of another, the source domain (concrete domains). In chapter 3, the example of an argument, taken from Lakoff and Johnson (1980), was explained. It takes the concrete concept of *war* and maps its meaning and connotations onto the abstract concept of *argument*, therefore inferring all the stemmed concepts of *war* onto *argument*. Therefore, expressions such as *shooting down the opponent*, *defending one's side*, and *hit the target* can be established and easily understood (Lakoff and Johnson, 1980:6-9).

The conceptual systems, which we use to think and perform action in the world, are metaphoric by nature, meaning that we use concepts to help us structure what we perceive in the world. The conceptual system that we make use of is largely metaphorical, which we are not knowingly aware of. This is investigated in the languages that we speak, and how we make use of them to conceptualise the world.

3.2.2. Metaphoric Structuring View

Abstract concepts are difficult to grasp in the real world. These are concepts that do not exist in the real world, only sometimes as sensory experiences (for example, the concept *sour* can be tasted and smelt, and the concept of *love* can be felt emotionally) and always as mental representations. Therefore, to conceptualise an abstract idea, individuals make use of metaphors. The idea behind the metaphoric structuring view is that an abstract concept is structured using metaphorical mappings which are grounded in experience. Time is an abstract

concept, often grounded in the concrete concept of space, from which it gets its structure. Following from this, it can be said that there are mutual conceptual structures between the concepts of time and space (Boroditsky, 2000:1).

The use of concrete concepts emerges from a set of experiences that are defined in their own terms. According to Lakoff and Johnson (1980), all concrete concepts have basic spatial relations, which refer to up and down, front and back. Other concepts that do not emerge out of experience therefore should be metaphoric in nature. In order to understand these metaphoric concepts, they are related to experiential concepts, in which the relational structure of the base domain is transferred onto the target domain. An example for this instance is when using a metaphor to talk about an abstract idea which reveal a source-to-target mapping in *the mind is a container* and *ideas are food* (taken from Boroditsky, 2000:2). The mind therefore functions like a container in which ideas can be stored. When referring to ideas as food, the ideas can be either hard to swallow, because they are not instantly understood, or they go down easily. With this source-to-target example, a systematic metaphoric relationship between abstract and concrete domains can be seen (Boroditsky, 2000:1-3). Another example for source-to-target mapping would be there are *many fish in the sea*, where *men* and *women* are the *fish* and the *world* is the *sea*. This phrase is usually applied in situations in which a man or a woman is looking to be romantic with another person but is most probably troubled to find their significant other. Then one would say, *there are many fish in the sea*, trying to calm the person down and telling them that they will find their significant other, with all these people on the world. This is therefore usually said about *love*, the main abstract concept to which the phrase refers to.

Through the experiences that we have we know that every moment in time only occurs once, that we can only physically be in one place at a time, that we can never physically go back in time, and that aspects of our daily experiences are not permanent. When pulling all these ideas together, it becomes clear that time will always be a continuous unidirectional flow which is marked by temporary objects and events that momentarily appear and disappear. These characteristics of time are universal across different cultures and languages and are directed through our experience in and with the world. What about aspects that are left unspecified by our experiences in the world? These aspects are specified in our language. The relation between

space and time in our language gives us insight in how the abstract concept of time is understood and structured (Boroditsky, 2000:3-4).

In the Metaphoric Structuring View, weak and strong versions exist. The weak version of the metaphoric structuring view proposes that spatial metaphors play a role in shaping the concept of time. However, when this relation between space and time is frequently used, an independent representation is established in the domain of time, where the constant relating to space is no longer needed. The strong version of the Metaphoric Structuring View states that the later part of the weaker view, in which the representation of time becomes independent of space, does not happen. In other words, the spatial schema is always necessary when then thinking about time. Information from the space domain is therefore always imported onto the time domain, and not stored (Boroditsky, 2000:4-5).

When talking about event sequences in English, two common spatial metaphors are used, which are the ego-moving and time-moving metaphors. The ego-moving metaphor represents the ego, or the individual, moving through the timeline towards the future, as in *we are moving closer to the deadline.* The time-moving metaphor is where the time flows past the ego from the future to the past as in *the deadline is coming up*. When individuals take on different viewpoints of time, then they will assign the front and the back of the timeline differently. This is visualised in Figure 1 below.

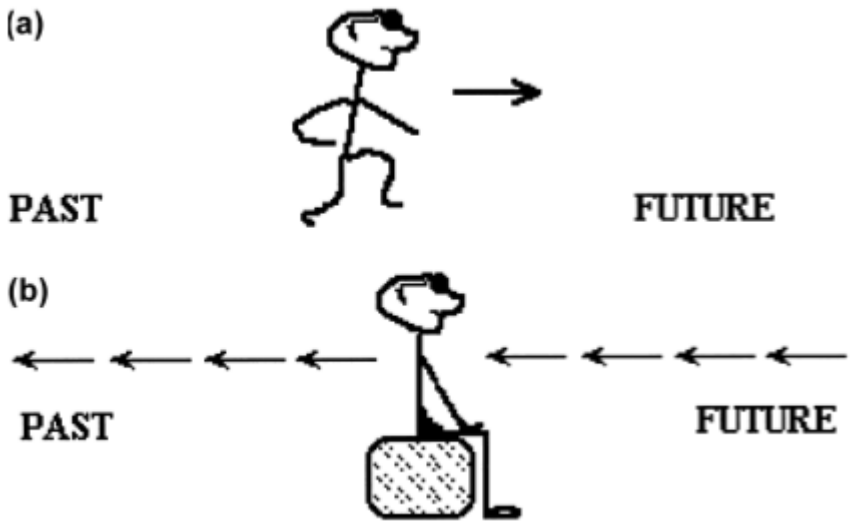

Figure 1: (a) Overview of the ego-moving diagram used to organize events in time. (b) Overview of the time-moving diagram used to organize events in time (Boroditsky, 2000: 5).

When taking on the ego-moving stance, the front is assigned to the future, or ahead of the ego. This falls in line with the observer's direction of movements, i.e. the direction towards which the eyes are facing. In the time-moving metaphor, the front is assigned to the past, which lies behind the ego. This is due to time flowing past the ego, and the front end of the temporal arrow ending up behind the ego.

The two domains of space and time share a conceptual structure, but also differ in various aspects. Space for example, is three-dimensional, and time is seen to be only one-dimensional, which makes space the richer domain. This leads to an asymmetrical association between space and time in our minds. In other words, when thinking about time, we are reminded to think about space, but not vice versa. Overall, individuals do not necessarily access the spatial domain when thinking about time, and when they do relate the abstract domain of time onto space, then this is influenced by the spatio-temporal metaphors used by the individual's language (Boroditsky, 2000:5-24).

3.2.3. Hierarchical Mental Metaphors Theory

Another theory that is suggested to explain the influence of language when conceptualising time onto space is the hierarchical mental metaphors theory (Casasanto and Bottini, 2014:474). As explained above, we use metaphors when thinking and speaking. This does not necessarily only focus on metaphorical language. We also think in so-called mental metaphors, which differ from linguistic metaphors. Mental metaphors refer to mappings concerning non-linguistic source and target domains, while linguistic metaphors on the other hand focus on mappings concerning linguistic representations (Casasanto, 2017:46-48). Mental metaphors have the flexibility to be shaped by language, culture and body while interacting with the environment and becoming rooted in our thought processes (Casasanto, 2017:46). The flexibility of these metaphors can be seen in studies that focus on temporal sequencing (for example, spatial primes that were horizontally orientated helped with the English speakers' judgments of temporal sentences like in *April comes earlier than May*) more than vertical primes (Boroditsky, 2001; Casasanto and Bottini, 2014:474; Fuhrman and Boroditsky, 2010:1430-1451; Santiago, Román, Ouellet, Rodríguez and Pérez-Azor, 2010:60-69; Tversky, Kugelmass & Winter 1991:515-557). The minimal exposure to cross-domain relations brought forth an alteration in the mental metaphors. These mental metaphors can be body-specific, language-specific, or

culture-specific. For example, people with a dominant right-hand tend to associate positive emotion with their right side of the body (more on Body Relativity in 3.3.3). However, these mental metaphors are not fixed. They can be altered through minimal exposure by, for example, "training" a right-handed person to work with their non-dominant hand for as little as 5 minutes (Casasanto, 2017:48). The cross-domain mappings (such as dominant right-handed people associating the right side with positive emotions) that are created when conceptualising the world develop according to a source-target relationship (in which the positive emotion is mapped onto the dominant side of the body) taken from our environments. From this there are two proposed hypotheses, they can be learnt through experience or they are innate to human knowledge. Due to people acquiring an overarching group of source-domain mappings from their environment, and these mappings are true to all environments in this world, the group of mental metaphors should be universal as well (Casasanto, 2017:6).

When variation in these metaphors occur, then these could be explained through either the strengthening or the weakening of these mappings. The determining factors regarding what mappings are strengthened and weakened, lies in the individual's language, culture and body (see section 3.2) that they reside in daily. For example, if an individual is used to hearing and then eventually using *back in the past*, then the corresponding mental metaphor will be activated, and the individual will conceptualise the past as behind them. When this mapping gets strengthened, then the mapping in which the past would lie in front of the ego gets weakened, due to the lack of use of it (Casasanto, 2017:7).

3.3. Experiential Relativity

In this section, an overview of experiential relativity will be given. Falling under this term are the components of linguistic relativity, cultural relativity, and bodily relativity, which will be looked at in further detail.

The umbrella term experiential relativity explains the minds of individuals are influenced through language, culture and their body. Therefore, people that speak different languages, grow up in different cultures or have different kinds of bodies, will be influenced by these mechanisms and will conclusively perceive and think about the world differently (Casasanto and Lupyan, 2015:555). This view chains together the idea of experiential relativity.

3.3.1. Linguistic Relativity

Differences are found between languages, how people conceptualize time and how they utilize space to make this possible. The above brings up the question, of whether language shapes thought, and if so, how? To answer these questions, it must be understood that there are two views on the current discussions about language and thought. The universalist view on the one side hypothesizes that human cognitive processes are guided by universal perceptual biases (Whorf, 1956: 148-150). The relativist view on the other side holds that human cognition is influenced by language. The differing definition of thought is what separates the two main lines of inquiry. The Sapir-Whorf hypothesis, which paves the way for the strong and weak view of linguistic relativity, holds that the construction of a language affects how the speaker views and makes sense of the world. Extreme views regarding the influence of language on thought are regarded as linguistic determinism, which defines that a person's language always and forever determines their thoughts. Empirically, this is an unsustainable claim, and is a construction simply built onto Whorf's ideas (1956:148-152). Linguistic relativity, on the other hand, is a weaker version of linguistic determinism, and explains that categories and the use of language only influences the thought processes and decisions that people make, and that this influence is not permanent or absolute.

Benjamin Lee Whorf (1956) concerned himself with the influence of language on nonverbal behaviour. Establishing the linguistic relativity theory, he holds that speakers of different languages are directed by their grammars (which has an influence on how they interpret reality) and arrive at a certain worldview. Followers of this view conceptualize thought along a range of nonverbal cognitive processes. Nonverbal in this sense means that these processes do not provoke or produce explicit speech production or understanding. It refers to cognitive responses to perceptual stimuli. Cognitive responses as a result of language have been recorded in the domain of colour (e.g. Regier & Kay, 2009; Roberson, Davidoff, Davies & Shapiro, 2005; Thierry, Athanasopoulos, Wiggett, Dering & Kuipers, 2009), time (e.g., Boroditsky, Fuhrman, & McCormick, 2011; Casasanto, 2008) and motion (e.g. Athanasopoulos & Bylund, 2013; Gennari, Sloman, Malt & Fitch, 2002; Kersten, Meissner, Lechuga, Schwartz, Albrechtsen, & Iglesias, 2010). These studies show that language may influence certain cognitive processes under certain conditions. Specific characteristics of the perceptual realm the linguistic category which might be under investigation, and the experimental procedure that either encourages or

suppresses the use of language, are factors that show the influence of language on thought (Bylund & Athanasopoulos, 2015:2; e.g. Athanasopoulos & Bylund, 2013; Trueswell & Papafragou, 2010; Winawer, Witthoft, Frank, Wu, Wade, and Boroditsky, 2007).

According to Wolff and Holmes (2011:253), linguistic relativity is usually associated with the Whorfian Hypothesis, and consists of these three main ideas:

i. Languages differ with regards to how they categorise reality semantically (how language makes meaning of its surroundings through concepts and connotations) and their syntactic structures
ii. An individual's perception and conceptualisation of reality can be influenced by the semantic structure
iii. Therefore, speakers of different languages conceptualise and perceive the world differently.

There can be found certain effects of language on thought, in other words a linguistic relativity phenomenon, that cannot be placed on a weak-to-strong continuum (Wolff and Holmes, 2010:255). The linguistic relativity phenomenon rounds up related proposals and groups them together in different kinds of families, rather than setting them on a continuum. Wolff and Holmes (2010) propose calling this a family tree of linguistic relativity, in which it is shown that language could have significant effects on thought, which could lead to thought differences amongst speakers of different languages (Wolff & Holmes, 2010:253).

To show the influence that language has on thought and therefore show evidence for linguistic relativity, studies need to regard the concerns that come with the investigation of linguistic relativity. These mainly revolve around the investigation of the influence that language has on thought while using language during tests. In other words, it brings forth the problem of circularity, because it tries to explain language and thought by using language in tests. In other words, the medium (language) that is used in tests, is the same as what is investigated (language). On top of that, the evidence produced through tests make way for only "weak" effects of language on cognition. To conquer these concerns, studies have been done that address differences in behaviour due to linguistic experiences, which are not to be explained with linguistic means during the test. This escapes the circularity that can arise from using language to explain language and its effect on cognition (Casasanto, 2016b:158-159; 165).

In English, motion verbs tend to define the manner of motion (e.g. flying, running), while in Spanish, motion verbs tend to define the path of motion (e.g. exiting, entering). This does not mean that English omits path information. It is included in clauses through the integration of, for example, prepositions (e.g. the man ran *away* from the robber). "Path languages" like Spanish and Korean omit the manner information overall (Casasanto. 2016b:159; Oh, 2003). Differences in linguistic encoding of manner and path was assessed in English and Korean speakers, looking at memories for motion events. The outcome of these studies was that English and Korean speakers did not differ in their path-relevant details, however English speakers recalled more manner related details than Korean speakers (Oh 2003).

An alternative to Whorf's linguistic relativity is Dan Slobin's (1996) view on language's influence on thought. The thinking-for-speaking hypothesis states that speakers of different languages think differently only when the speaker is in the process of preparing (selecting and structuring) content for speech. The speaker, according to this theory, pays attention to and verbalizes things that can be encoded in the speaker's language. As can be seen from this, Slobin's theory focuses on verbal behavior. Information that is utilized for speech is conceptualized and therefore central to this theory. Evidence for this model is however not focused only on verbal behavior, but also include co-verbal behavior. Co-verbal behavior is behavior that occurs simultaneous to speech and includes to what aspect in reality the speaker pays attention and gestures. Language plays one of many roles in the differences seen in speakers regarding the way they select and organize information in communication (e.g. Berman & Slobin, 1994; Hasselgård, 2002; Strömqvist & Verhoeven, 2004), concepts expressed through gesture (e.g., Gullberg, Hendriks, & Hickmann, 2008; Núñez & Sweetser, 2006), and the details speakers pay attention to when asked to describe something (e.g., Papafragou, Hulbert, & Trueswell, 2008; von Stutterheim, Andermann, Carroll, Flecken, & Schmiedtová, 2012).

Further, thinking-for-speaking argues that the language a person speaks should affect the cognition during the encoding and decoding of our thoughts into words (Slobin, 1996:75-76). It implies that speakers of different languages specify and focus on different kinds of information in speech and therefore interpret reality in different ways. An example given by Slobin (1996) is the difference in manner in English and Spanish speakers when they describe motion. In English, speakers tend to specify manner of motion (e.g. running, flying, rolling),

where in Spanish, speakers specify path of motion (e.g. entering, exiting) (Casasanto, 2016b:158-159). This suggests that the way people code their experiences into language can influence how speakers of different languages perform on non-linguistic tasks. This thinking-for-speaking hypothesis was tested in non-linguistic memory tasks, in which results could be interpreted following the thinking-for-speaking path. "Speaking" in this sense includes the covert encoding of experiences into words, when having to remember something (Casasanto,2016c). A speaker therefore will put their focus on different aspects on the memory being recalled, encoding this information into words and communicating this with the outside world.

3.3.2. Cultural Relativity

Cultural relativity explains how culture has an influence on how people perceive and interpret the world. Culture can be comprised out of various things, starting at peoples' beliefs, their behaviours, down to the objects used in that culture, and other characteristics shared by people belonging to a group forming part of that culture (Deane, 2015). In today's time and age, internet can also be labelled as a culture, and could be named an internet culture. By investigating the different values put on characteristics making up a culture, can give an insight into how a group thinks, what their practices are, and how they view the world. Cultural relativism alleviates ethnocentrism. Ethnocentrism is when one judges an external culture through the lens of one's own culture. When having a look at the mapping of time onto space, different cultures have different explanations on why they would map time in a certain way onto space.

In English and most Western cultures, the flow of time on the horizontal axis has been accounted for by the reading and writing direction in a culture (Bonato et al., 2012:2260; Casasanto and Bottini, 2014:477), as well as the directional flow of time on calendars, graphs and other cultural artefacts (Tversky, Kugelmass and Winter, 1991:529). When individuals read and write, then they (typically) move their eyes, hands and body either along a lateral axis or along a vertical axis, determined by the orthographic convention. In English, for example, we read and write from the left to the right, which influences how we conceptualise time, which occurs laterally. In other words, the reading and writing direction determines the lateral orientation of time on the mental timeline, on which the past lies towards the left and the future

towards the right. In different cultures, where the reading and writing direction flows from the right to the left, the opposite is found, i.e. the past lies towards the right and the future towards the left (Casasanto, 2016a:722).

Cultural artefacts (such as graphs and maps) and orthography are further influential factors that determine thought processes (Casasanto, 2016b: 166). This can be seen when looking at spatial metaphors for time in Western languages, which predominantly focus on the sagittal axis (the front-back axis), not on the lateral axis (the left-right axis), which is determined by the culture's orthography (Bonato et al., 2012:2264). Orthography in this sense, is referred to as cultural relativity. It explains the influence of culture on people in a similar way. An example, which has been mentioned before, is the flow of orthography in English and Arabic. In English, the reading-writing direction is from the left towards the right, while in Arabic it is from the right towards the left. These directional flows of orthography (in English and Arabic) influence the mapping of time onto the mental timeline. In English, past is mapped towards the left, and the future towards the right. In Arabic, it is the other way around. Culture has such an influence on a person that it can form part of shaping an individual's mind (Casasanto, 2016a:715). When looking across different cultures, then it becomes clear that people have similarities and differences regarding how they conceptualise time. People conceptualise time along what is called a mental timeline, which is universal amongst cultures, but the direction in which time flows varies between cultures (Bonato, Zorzi and Umiltà, 2012:2260). Cultural relativity is necessary to understand how mental timelines are construed, since linguistic metaphors cannot account for the view of time as flowing from the left towards the right on the mental timeline found amongst cultures (on which the past would lie towards the left and the future towards the right, in, for example, English).

An instance in English would be if people would say that *Monday is towards the left of Tuesday*, rather than *Monday comes before Tuesday*. Physical experience is in the same boat. It cannot account for time flowing from the left to the right. In the physical world, we do not experience events in the past towards our left, and events that will happen in the future to the right. Rather, past events lie towards the back of the ego, and future events lie towards the front of the ego, which are mediated by the way we move through the world, and by the spatio-temporal metaphors we use. Regarding movement through the world, our eyes are towards the front and give us sight about the unknown, towards which we walk. The spatio-temporal metaphors that

appear in the languages that we speak refer the future towards the front and the past towards the back, as in *we look into the future*, and *we leave the past behind us*. However, the mental timeline still flows from the left to the right, horizontally, or from the top to the bottom, vertically (Casasanto, 2016a:722).

When a speaker speaks about time and refers to anything else than the actual physical space, this involves a mapping between the real and the represented space. The nature of these mappings is culturally mediated, and therefore brings forth cross-cultural variation. One could say that gestures embody a blend between the actual physical space, which could be the space in front of the body, and other spaces, which could be the space that the gesture refers to that are exist mentally. For example, when describing generations. When one refers to your children's and their children's generation, then the speaker might use the physical space in front of them to describe the other mentally referred to space, which would be your children's and their children's generation.

3.3.3. Bodily Relativity

In this section, bodily relativity will be discussed. This notion suggests that bodily experiences influence and guide how people think. It suggests that people with different kinds of bodies will think, interact, feel and decide differently, while also forming different kinds of neural and cognitive representations (Casasanto, 2009:351; Casasanto and Henetz, 2012:370). As Casasanto's body-specificity hypothesis states, the body is crucial to the contextual interactions with the world and therefore the mind is dependent on the structure of the body (Casasanto, 2011:378; Casasanto, 2009:351). The body-specificity hypothesis relates to the theory of bodily relativity and has been proven to carry validity by various experiments across various populations (Casasanto, 2009:353-360; Casasanto and Jasmin, 2010:2-5; Casasanto and Chrysikou, 2011:420-421). One of the first experiments in this area focused on the handedness, in which it became clear that differences in the body's use and function resulted on the lateral axis. As it is known that the left side of the body is controlled by the right side of the brain, and vice versa, left- and right-handed people will use the right and left hemisphere of the brain, respectively, to conceptualise activities (Casasanto, 2014:108-109).

One of the most prominent findings regarding bodily relativity research is the relation between motor experience and emotional valence (Casasanto, 2014:109-111). Right-handed individuals

predominantly associate positive ideas, such as love or intelligence, with the right side of the body, while left-handed individuals would associate positive ideas with their left side of the body. Furthermore, right-handed individuals tend to prefer things appearing on the right side of space, while left-handed individuals show the opposite preference. Right- and left-handed people have also been shown to use different neural tissues when understanding action verbs, as demonstrated through their brain activity, scanned using functional magnetic resonance imaging (fMRI). This shows that different kinds of bodies have an influence on different conceptual processes (Willems, Hagoort, and Casasanto, 2010).

The positivity and negativity associated with the different sides of the body are said to come from the positivity expressed towards a greater motor fluency in left- and right-handed individuals (Casasanto, 2016a:725). The human body is usually askew, in which people have a dominant and a non-dominant side, which leads to a person having greater motor efficiency in one side of the body. The most visible and common example in humans is handedness. Judgements guided by emotion are therefore associated with the ease of use of the dominant or non-dominant side of a person, where the left or right side of the body is associated with either positive or negative emotions.

Although these relations are found amongst all individuals, individuals can have their implicit relations between space and valence altered (Casasanto and Chrysikou, 2011:420-422). The association between space and valence can be altered in such a way that the idea that the association between positive and negative emotions with the left and right side of the body is strengthened through action. Therefore, if an individual would be made to have trouble with their dominant side (in an experiment for example), then their perception between valence and space could be altered and a new pattern of experience could have been developed (Casasanto, 2016a:726).

Overall, experiential relativity shows, that our thought patterns and cognition is flexible. It can be seen through research which exposes participants to new patterns of linguistic (Boroditsky, 2001:18-19), cultural (Casasanto and Bottini, 2014:474), and bodily experiences (Casasanto and Chrysikou, 2011:421).

3.4. Deictic temporal reference and sequential temporal reference

Most aspects of time in Germanic languages can be expressed in spatial terms. These expressions can be points in time, long or short durations, and events that can be moved forward or pushed back in time. No matter what is described in time, these space-time metaphors imply either a deictic-based (ego-centred) or sequence-based (ego-independent) perspective. This means that one can take on two different perspectives: The deictic temporal reference or the sequential temporal reference. The difference between these two perspectives can be understood with regards to riding a train. Temporal deixis occurs when the experiencer is travelling inside a train, where temporal sequence is when the experiencer watches the train travel from a distance (Núñez & Cooperrider, 2013:223; Haspelmath, 1997:59-60; Levinson, 2003:29-34; Evans, 2004:61). These multiple perspectives are explained further below.

3.4.1. Deictic temporal reference

When looking at English, time is talked about as if it would flow along the speaker's sagittal axis, on which the future lies towards the front and the past towards the back. This can be seen in phrases like *we are looking forward to the future* and *we look back onto our childhood.* The timeline is metaphorised as a horizontal line flowing from behind the speaker towards the front of the speaker, which is otherwise also referred to as flowing on the sagittal axis. The deictic temporal reference comes in the perspective that is taken when speaking about time. The future and the past are located on the mental timeline with reference to the speaker. In other words, the future will lie ahead of the speaker and the past behind the speaker, with the speaker metaphorically standing on the now and facing towards the future (Casasanto, 2016c:171).

When specifying time with metaphors that have a deictic reference, these expressions often use spatial terms that specify the path on the sagittal axis towards which the future and the past flows.

(1) Temporal deixis with spatial metaphors:
   a. It will happen a long time *from now, far ahead* in the future.
   b. It happened a long time *ago, way back* in the past.

It is, however, also possible to specify deictic temporal reference with spatial metaphors that leave direction unspecified (2a-b).

(2) Temporal sequence and spatial metaphors:

a. It will happen *far from* now in the future.

b. It happened in the *distant* past.

In sentence (1) and (2), the italicized expressions are the spatial metaphors that signal if the speaker is talking about the future or the past, but the italicized spatial metaphors in (2) are non-spatial. In other words, they do not signal towards what direction the future and the past flow.

3.4.2. Sequence temporal reference

Another way of referring to time is when describing a sequence of events that are located on the mental timeline, but located relative to each other, and not to the ego.

(3) Temporal sequence and spatial metaphors

a. Tuesday comes *before* Wednesday.

b. Saturday comes *after* Friday.

Looking at these examples, it makes sense that people move through time only in one direction – from the past into the future. Therefore, there are no questions asked that Tuesday comes before Wednesday, and Saturday comes after Friday. This relationship of before and after is same for all humans. It can therefore be said, that sequences of events are spatialized along an axis if the speaker conceptualizes himself as facing towards the future, which would be facing forward. The sagittal axis that is therefore referred to when speaking about time is more strongly implied by the deictic metaphors seen in (1) and (2), rather than by the sequence metaphors seen in (3) (Casasanto, 2016c:171-172).

4. Methodology

The following chapter describes and explains how the experiments for this study were designed, set-up and executed. The research methodology used in these experiments are the means to investigate the research questions set out at the beginning of this thesis. The layout and the comparison between the two experiments follows the structure of Casasanto and Jasmin's (2012) experiments, which focused on the spatial axes used by native English speakers when gesturing about time. To recapitulate, the main aim of the present thesis is to examine to what degree Afrikaans speakers refer to the sagittal, horizontal and vertical axis when deliberately and spontaneously gesturing about time.

4.1. Ethical Clearance

The Research Ethics Committee: Humanities of Stellenbosch University complies with the South African National Health Act No. 61 2003 as it relates to health research. Additionally, this committee abides by the ethical norms and principles for research established by the Declaration of Helsinki (2013) and the Department of Health Guidelines for Ethical Research: Principles Structures and Processes (2nd Ed.) 2015. Both experiments have gone through the process of the ethical clearance application, of which the research proposal, data collection tools and informed consent form of the first experiment (REC approval project number: GENL-2017-0343-285) was approved by the Research Ethics Committee for Human Research (Humanities) on 7th July 2017 and is valid until the 6th July 2020. The research proposal, data collection tools and informed consent forms for the second experiment (REC approval project number: 6591) have an ethical approval period from the 17th April 2018 until the 16th April 2021. The data for this experiment was thus collected in the abovementioned approval period.

4.2. Experiment 1

The aim of experiment 1 was to investigate what axis L1 Afrikaans speakers use to deliberately anchor their gestures about the past and the future.

4.2.1. Method

4.2.1.1. Participants

A total of 67 Afrikaans speakers participated in this experiment. However, three were removed, due to them being left-handed and this could be a confounding factor in the handedness analysis done in this experiment, which investigates the laterality effect of the mental timeline assumed to be presented in the hands used, when gesturing about the future and the past. Of the remaining 64 participants, 38 were female and 26 male, and all had their right-hand as their dominant hand. This was tested with the Edinburgh Handedness Inventory. All participants lived in Stellenbosch and surrounding areas and were between the ages of 18 and 48 with the average of 23 years (standard deviation 5.8). One requirement that determined if participants were included in the experiments was having Afrikaans as a first language. In other words, Afrikaans was the language that they learnt first in life. Participants overall judged themselves as being 4.9 out of 5, equal to the nominal value of 'almost excellent' proficiency in Afrikaans and speaking it an average of 4.7 out of 5, equal to the nominal value of 'almost all the time' of the week. Some of the participants stated that they do not distinctly only use one language at a time. In other words, when they speak, they mix and match English and Afrikaans, according to the context and people they are speaking (such as friends or colleagues).

Other languages that came up as being spoken amongst all participants as second languages was English, having been acquired at an average age of 5 years, with a self-rated proficiency of 3.7 out of 5, equal to the nominal value of 'average', and an average weekly spoken frequency of 3.3 out of 5, equal to the nominal value of 'average'. English was learnt through TV, other sources of media, in school, or sometimes at home, when the child reached the age of going to kindergarten or school.

Amongst the participants that had German as an additional language, this language had been acquired around the average age of 16. The self-rated proficiency had an average of 2.3 out of 5, equal to the nominal value of 'just above rudimentary', while only being used an average of 1.5 out of 5 during a week, equal to the nominal value of 'seldom'. The participants that spoke Dutch as an additional language acquired it around the age of 16 and had an averaged proficiency of 2.3 out of 5, equal to the nominal value of 'just above rudimentary', while speaking it only about 1.5 out of 5 a week, which is equal to the nominal value of 'seldom'.

Participants that acquired isiXhosa did so at an average of 14 years of age and had a proficiency of 1 out of 5, equal to the nominal value of 'rudimentary', and spoke it about 1.2 out of 5 a week, which is equal to the nominal value of 'seldom'.

4.2.1.2. Materials

Questions

The four pairs of questions were taken from Casasanto and Jasmin (2012), which they also used in their experiment. These questions deliberately ask how the participant would gesture, if they would gesture for the future/past. The Afrikaans version of the questions had been translated from English and then back-translated to English to ensure consistency. The four pairs of questions, in English and Afrikaans, can be found in Table 1. The eight questions are divided into two main groups, namely one using sequential language and the other using deictic language. All questions start with "How would you gesture about things that…" in English, and "Hoe sou jy gebare gebruik as jy verwys na goed wat…" in Afrikaans:

Table 1: Questions posed to participants. Each question begins with "Hoe sou jy gebare gebruik as jy verwys na goed wat…" (See continuations below).

	English Original Version	**Afrikaans Translated Version**
	"How would you gesture about things that…"	Hoe sou jy gebare gebruik as jy verwys na goed wat
	Deictic reference, directional language	
Future	… will happen a long time from now, far ahead in the future?	… baie lank van nou af sal gebeur, ver vorentoe in die toekoms?
Past	… happened a long time ago, way back in the past?	… lank gelede gebeur het, ver terug in die verlede?
	Deictic reference, non-directional language	
Future	… will happen a long time from now, in the distant future?	… baie lank van nou af sal gebeur, in die verre toekoms?

Past	… happened a long time ago, in the distant past?	… lank gelede gebeur het, in die verre verlede?
	Sequence reference, directional language	
Future	… will happen in your children's generation, and then a generation after that?	… in jou kinders se generasie sal gebeur, en dan 'n generasie na dit?
Past	… happened in your parents' generation, and then a generation before that?	… in jou ouers se generasie gebeur het, en dan 'n generasie voor dit?
	Sequence reference, non-directional language:	
Future	… will happen in your children's generation, and then a generation later than that?	… in jou kinders se generasie sal gebeur, en dan 'n generasie later as dit?
Past	… happened in your parents' generation, and then a generation earlier than that?	… in jou ouers se generasie gebeur het, en dan 'n generasie vroeër as dit?

Table 1: Questions posed to participants. Each question begins with "Hoe sou jy gebare gebruik as jy verwys na goed wat…" (See continuations below).

As seen from the examples above, the questions are sectioned into two main categories, deictic reference and sequence reference. This is to test if perspective had an influence on how Afrikaans speakers anchor their gestures onto an axis. Deictic reference portrays an ego centred perspective, in which the ego, or in this case the participant or gesturer, moves through time, either internally or externally, as in "…will happen a long time from *now*…" or "…happened a long time *ago*…". In other words, there is a reference point at a specific point in time. Sequence reference on the other hand is where time is observed with regards to earlier and later relationships, as can be seen here "…in your children's generation, and then a generation *later* than that…" or "…in your parent's generation, and then a generation *earlier* than that…" (Núñez & Cooperrider, 2013:222).

One of the four pairs of questions were randomly assigned to eight of the 32 participants. This was done with all four pairs of questions and counterbalanced with the other 32 participants. In

other words, 32 participants of the total 64 participants were asked about the future first, and 32 of the total 64 participants were asked about the past first.

Language Questionnaire

A language questionnaire was also distributed, which is found in Appendix B**.** This recorded information on the participants' proficiency in Afrikaans, and additional languages including English. This made it possible to analyse the potential confounding factor of language and consider this. The language questionnaire also elicited information on frequency of language use and age and context of acquisition of each of the participants' languages. The rating scale was from 1 to 5, with 1 being "rudimentary" and 5 "excellent". In the second question, which enquired about frequency of language use, the rating scale was again from 1 to 5, but this time, 1 standing for "seldom" and 5 being "almost all the time".

Edinburgh Handedness Inventory

An interesting perception that was added to this research was the influence of handedness and the displaying of the future or the past with regards to what hands participants used. The formal Edinburgh Handedness Inventory was sent out to the participants for them to fill in and send back. All questions in this inventory started with "Which hand do you prefer to use when…" and then different 19 different objects and activities were listed, such as "writing", "using a comb", and "opening a box (lid)". The participant was then required to rate himself from a scale from "Right hand strongly preferred" to "Left hand strongly preferred". At the end of the questionnaire, one had to apply a formula to get a percentage. This percentage shows how dominant your left hand or your right hand was in your daily activities. In other words, the higher the percentage at the end, the more right handed the participant will be. This questionnaire can be found in Appendix C. In this aspect, it was additionally investigated if the handedness has an influence, regarding with which hand either the future or the past was portrayed. I ensured that all participants were right-handed and excluded the three left-handed participants that did take part in the experiment. This excludes the confounding factor of handedness perhaps playing a role.

4.2.1.3. Procedure

Participants were recruited through social networks, as mentioned above. When they agreed to participate in the study, they were then invited on doodle.com to select a 15-minute timeslot on a time table grid, which specified the venue, days, dates and times. Participants could anonymously sign up and chose a time slot to their liking. A total of 64 participants were included into the experiment. Participants were invited into the Multilingual and Cognition Lab in the General Linguistics Department to complete the experiment. The Multilingual and Cognition Lab is a space, which can accommodate group experiments in the lounge area, equipped with a video camera, a double-sided mirror, and a sound proof door. The Participants were all investigated individually in the lounge, and seated on a chair across from the examiner. The participants were also video recorded. On arrival, the participant received a consent form, which stated the necessary information regarding the experiment, why it is executed and that the participant could quit the experiment whenever they feel the need to, and that all their personal information was kept anonymous. The consent form stated deliberate temporal gestures amongst Afrikaans first language speakers is investigated. Further questions were answered after the experiment was executed.

After the consent form was read and signed, the experiment would start. It was explained to participants what was expected of them, and that they participant should ask the researcher any questions if they did not understand what was asked of them. Afterwards, participant listened to the first question of the question-pair recordings, the participant had to show how they would use gestures to portray the event in question. After the first question was answered, the participant listened to the second question, and responded to it. As mentioned above, the order of questions was counterbalanced amongst participants. The participants themselves asked minimal questions, presumably due to the introduction being quite clear and participants instantly knowing what was asked of them.

After the experiment was executed, the participant got a chance to complete the language questionnaire. After the language questionnaire was filled out, the experiment was completed, and the participant naturally and informally gave feedback or asked to find out more information regarding the experiment. Here, participants were asked whether they were aware of which hands they had used during the experiment.

Only after the experiment session, was the Edinburgh Handedness Inventory sent out to all the participants, for them to fill out and send back.

4.2.2. Data collection and analysis

Participants were told explicitly that they should ask questions if they do not understand something or do not know how to answer a question.

After all the data was collected, the data was coded on an excel sheet. Each participant was assigned a random number from 1 to 64 and grouped according to which pair of questions of the four pairs the participant listened to. The 32 participants that listened to the order in which the future was asked first were coded on one sheet, and the other 32 participants that listened to the questions, which asked about the past first were coded on another sheet. The answers were split into the future and the past, and then coded according to which axis the participants referred to (either the lateral, sagittal or vertical), and towards what direction the future and the past lies (e.g. future towards the front and past towards the back). All answers given by participants were clearly codable along the mentioned dimensions. In this regard, the future or the past could be towards the left or the right, away, towards or behind the body. Additionally, the hand they would use when talking about the future or the past (e.g. participant 08 used the left hand for the past and the right hand for the future).

The data was then analysed by calculating percentages overall, looking at which axis was predominantly used when participants were deliberately asked to gesture about the future and the past. Then the four conditions were analysed in order to see if the use of axis between the four groups (deictic directional language, deictic non-directional language, sequential directional language, and sequential non-directional language) differed in any way with regards to the axis used, handedness and directionality of placing the future and the past.

Chi-squared tests were applied to obtain an interpretation of the statistical significance of any correlation found between variables.

4.3. Experiment 2

The second experiment focused on spontaneous temporal gestures, and on which axis L1 Afrikaans speakers anchor these. While this experiment follows the experimental paradigm

established by Casasanto and Jasmin (2012) for assessing spatial axes of spontaneous temporal gestures, it relies on its own, original set-up of Afrikaans elicitation material.

4.3.1. Method

4.3.1.1. Participants

Participants were recruited through social networks and were given the opportunity to notify the researcher either in the initial contact when they would be available to take part in the experiment, or they were able to choose an available 30-minute timeslot on the online website called doodle.com. Participants could anonymously sign up and chose a time slot to their liking. All the experiments took place in the Multilingualism and Cognition Lab in the Arts and Social Sciences Building. The lounge, which forms part of the lab is a neutral, quiet, and a big enough space in which the participants executed the experiment.

A total of 32 participants were recruited, of which there were 59% female participants and 41% male participants. Of the overall 32 participants, 6.3% were left-handed, and 93.7% were right-handed. This was tested using the Edinburgh Handedness Inventory. All participants lived in Stellenbosch and surrounding areas and were asked to fill out a language background questionnaire, inquiring about all the languages that the participant can speak, and the Edinburgh Handedness Inventory, collecting data regarding what dominant hand each participant had. Participants were between the ages of 18 and 29 with the average lying at 22 years with a standard deviation of 5.806. One requirement that determined if participants were included into the experiments was having Afrikaans as a first language (as in Experiment 1). One of the other languages that came up as being spoken amongst participants was English as a second language amongst all participants. Participants rated their proficiency in Afrikaans, which amounted to an average of 5 out of 5 on the self-rating scale, which equals to the nominal value of ‘excellent’. In a week, participants stated that they spoke an average of 4 out of 5 a week, equal to the nominal value of ‘almost all the time’.

On average, the English-speaking proficiency was 4 out of 5, equal to the nominal value of ‘very good’, while they spent about 4 out of 5 of their week speaking English, which is equal to the nominal value of ‘almost all the time’. The average age of acquisition was at six years, where they acquired it either through TV or school. isiXhosa was amongst one of the additional languages, that some of the participants acquired. Participants were about 2 out of 5 proficient,

which equals the nominal value of ‘just above rudimentary’ and spoke it about 1.5 out of 5 of a week, which is equal to ‘seldom’. Dutch was also found to be spoken amongst some participants. It had a proficiency level of 1.5 out of 5, equal to the nominal value of ‘rudimentary’, while it being spoken only about 0.5 out of 5 during a week, which is equal to ‘seldom’. French was found to have similar results like Dutch, of which participants rated themselves of having an averaged 1.5 out of 5 proficiency level, while speaking it about 1 out of 5 during a week. Lastly, participants that spoke Chinese had a proficiency of an average of 1 out of 5, with the frequency per week also lying at 1 out of 5. The additional languages were either learnt at university or at school.

4.3.1.2. Material

As mentioned above, two consent forms were given to the participants. One before the whole experiment started, and one after the experiment was completed. This was done, because the participants had to be misled to elicit spontaneous gestures. The only difference between the two consent forms are the title of the research and the purpose of the study. The first consent form gives the research the title “The study of storytelling of first language Afrikaans speakers” and the purpose for that experiment was “to understand how persons with Afrikaans as a L1 retell stories. This will make clear what influence language, experience and thought have on each other”. This type of deception was used because participants had to read short stories, familiarise themselves with them and then retell them back to their partner. The second consent form, which was handed to the participant after the occurrence and the reason for the deception had been clarified to the participant, contained the actual title and purpose of the research. On the top of the consent form, the title of the study was “The study of temporal gestures of first language Afrikaans speakers”, with the purpose evolving around the understanding of how persons with Afrikaans as their first language use temporal gestures to speak and gesture about past and future events.

Stories

Before the participant received the stories, they were given an instruction page, which can be found in Appendix F. On this instruction page, each step was explained in detail for all the three short stories that all the participants had to read and retell. For each story, the instructions were the same. The stories were all written in second person, and the participant was advised to retell

the stories in first person. This was to make the participant focus and think about the story more in depth, because they have to rethink the perspective they will retell the story in, compared to the perspective they read it in. This allows for better retention and attention to detail. After the participants are done reading through the instructions, then at the bottom of the page, and again emphasized verbally, that if they had any questions then they should not hesitate to ask.

The stories are made up and were written by the investigator. Each story was about 100 words long, with the shortest being 79 words long, and the longest 107 words. The groups in this case consisted out of deictic spatial metaphorical language, deictic non-spatial metaphorical language, sequence spatial metaphorical language and sequence non-spatial metaphorical language. In each group, there was a story for the future and a story for the past. Additionally, there were two warm-up stories, which did not follow the temporal rules of any of the abovementioned groups. These stories were given to the participants before they started the actual experiment and served as an ice-breaker, to get the participants comfortable and used to the setting and experimental requirements. Below, an example for the deictic spatial metaphorical language for the future and the past and one example for the sequence spatial metaphorical language, also for the future and past, can be found. In these examples, for the reader's convenience, the temporal language has been italicized. Also, the translations in English have been given for non-Afrikaans speaking readers, in which one can also see the italicized temporal language and the layout of the story. The complete selection of stories can be found in Appendix H.

Deictic spatial-metaphor

Future

English

Your mother said, that *in the near future,* you should get a mirror. You think, that you can look at your top half in the bathroom mirror and you see your feet any time in the shoe store. *Looking forward into the future*, she wants you to see your whole outfit. So, *tomorrow* you will head out and buy one. You start wondering, whether there might be more to your mother's request than she leads on. Suppose, she thinks you have no fashion sense? She says, that's not it. A *long time from now*, you will appreciate having a full-length mirror.

Afrikaans

Jou ma het gesê dat jy in die *nabye toekoms* 'n spieël moet kry. Jy dink dat jy na jou boonste helfte in die badkamer se spieël kan kyk en jy sien jou voete enige tyd in die skoenwinkel. *Met die oog op die toekoms*, wil sy hê jy moet jou hele uitrusting sien. So, *môre* sal jy uitgaan en een gaan koop. Jy begin wonder of daar dalk meer aan jou ma se versoek is as wat voorkom. Veronderstel sy dink jy het geen modekennis nie? Sy sê dit is nie so nie. *'n lang tyd van nou af* sal jy 'n lang spieël waardeer.

Past

English

When you were younger, the ice on the river wasn't this thin. *Way back then*, you were still able to skate on the rivers. The birds never used to go this far north. *Yesterday*, you and your father watched as they came in. You were thinking that *many years back*, there used to be more ice on earth. But you will never experience such an amount of ice in your life time. Although, this makes you want to *go back in time*, you decide to enjoy these last few winters.

Afrikaans

Toe jy jonger was, was die ys op die rivier nie so dun nie. *Destyds* kon jy nog op die riviere ysskaats. Die voëls het nooit voorheen so ver noord gegaan nie. *Gister* het jy en jou pa gekyk toe hulle ingekom het. Jy het gedink dat daar *baie jare gelede* meer ys op aarde was. Maar jy sal nooit so 'n groot hoeveelheid ys in jou lewe ervaar nie. Alhoewel dit jou laat wens *om terug te gaan in tyd*, besluit jy om hierdie laaste paar winters te geniet.

Sequence spatial metaphor

Future

English

Looking ahead into the future, holed up in this place, you are not able to stay any longer. It's your birthday *in a few days' time*, marking 21 years. In the *two weeks coming*, you are not going to spend them hiding in this place. *Thinking ahead*, the temperature is going to dip, so you hope you will get some winter clothing that you are able to *give to your children one day*. If they take care of them, then *their children* could also have a use for them.

Afrikaans

As jy *vooruit kyk na die toekoms*, opgesluit in hierdie plek, kan jy nie langer bly nie. Dit is jou verjaardag *oor 'n paar dae*, dit merk 21 jaar. In die *twee weke wat kom*, gaan jy hulle nie spandeer deur in hierdie plek weg te kruip nie. *As jy vooruit dink*, weet jy die temperatuur gaan sak, so jy hoop jy sal wintersklere kry wat jy *eendag aan jou kinders kan gee*. As hulle dit oppas, dan kan *hul kinders* ook daarvan kan gebruik maak.

Past

English

Your dad's generation smelled of cigarettes. *Your grandfather's generation* smelled like whisky. *Your grandfather's generation before that* smelled of citrus. The men in your family believe that a person's personality can be smelled miles away. They used to give you perfumes, *way back then* when their salary was still good. Living in the past has never been from one pay check to the next, which makes you want to *move back in time*, so you could have bought yourself whatever you wanted, whenever you wanted.

Afrikaans

Jou pa se generasie het na sigarette geruik. *Jou oupa se generasie* het soos whisky geruik. *Jou oupa se generasie voor dit* het na sitrus geruik. Die mans in jou familie glo dat 'n persoon se persoonlikheid myle weg geruik kan word. Hulle het altyd vir jou parfuum gegee, *destyds toe* hulle salaris nog goed was. Lewe in die verlede was nooit van een loon na die volgende nie, wat jou laat wens *om terug te beweeg in tyd*, sodat jy vir jouself kon gekoop het wat jy wou, wanneer jy wou.

Language Questionnaire

As in the first experiment, the language questionnaire stayed the same and was also distributed, which is found in Appendix B**.** This questioned the participants' proficiency in their first language Afrikaans, and additional languages such as English, and made it possible to analyse if there are confounding factors and consider these. The language questionnaire was created to elicit information on language use and frequency, proficiency, age and place of acquirement regarding the different languages the participant could speak.

Edinburgh Handedness Inventory

The same handedness questionnaire was utilised as in the first experiment. The Edinburgh Handedness Inventory included questions asking with "Which hand do you prefer to use when…" after which 19 different objects and activities were listed, such as "writing", "using a comb", and "opening a box (lid)". The result showed how strong your left hand, or your right hand was. The document of this questionnaire can be found in Appendix C.

4.3.1.3. Procedure

Participants were recruited through social networks through friends and colleagues. When they agreed to participate in the study, they were then given available timeslots during the day from which they could choose one that suited them best. When a time and date was set, then they would come to the Multilingual and Cognition Lab in the General Linguistics Department and complete the experiment. Participants were urged to bring along an Afrikaans first language speaker, to make the experiment in pairs more comfortable. If the participant was not able to bring a friend, then the participant had to execute the experiment by themselves. On arrival, the participants were seated on two chairs, facing each other. The experimenter was seated further away from the participants, to be able to see both participants' gestures. Issues with some of the seating arrangement will be discussed in the limitations section of this study.

Participants received a consent form, which stated the necessary information regarding the experiment, why it was being executed and that the participant could quit the experiment whenever they feel the need to, and that all their personal details were going to be kept anonymous. After the consent form was read and signed, the experiment would start. The first page given to the participants was the instruction page, which explained what was expected of the participants when they would be handed the stories. After they have read the instructions, they would be given the first story, which was the warm-up story and did not fall into any of the four mentioned groups. This ensured that the participants became comfortable with the experimental situation and had the opportunity to ask questions if something was unclear. When the participant read and familiarised themselves with the story for about one minute, then the story would be taken back by the investigator and one participant of the two presents could start to retell their story. Usually the participants decided by themselves who was going to go first.

If this was not the case, then the investigator just told the person on the left to start retelling their story.

When the warm-up story was retold, then the participants were given the second story and the same procedure was followed. Participants were randomly assigned to the different story-groups, consisting of narratives that they would have to read and retell. Each pair of participants got one version of the story, i.e. either the stories containing spatial or the non-spatial language. Each partner then retold one story of each type, for example either the story with deictic language or the story with sequence language, both for the future and the past. In other words, participant A and participant B would get the story version with the spatial language. Participant A would then have to retell the story containing deictic spatial language for the future and the past, and participant B would have to retell the story containing sequence spatial language for the future and the past.

After both participants read and retold all three stories, they were then enlightened that they were 'deceived' and had to fill out the "real" consent form, which explained the actual reason for the experiment. The participant then got a chance to complete the language questionnaire and Edinburgh Handedness Inventory.

After the questionnaires were filled out, the experiment was completed, and the participant naturally and informally gave feedback or asked to find out more information regarding the experiment. Insight into this feedback will be given in the last subheading for this experiment.

4.3.2. Data collection and analysis

This research was carried out at the Multilingualism and Cognition Laboratory, Stellenbosch University. Each participant was urged to bring along a friend who they could participate with. The data was recorded and stored on a hard drive. Each participant was told explicitly that they should ask questions if they do not understand something or do not know how to answer a question. A few questions were asked after the introduction was read. These questions revolved around whether they understood the introduction correctly.

After all the data was collected, the data was coded on an excel sheet. Each participant was assigned a random number from 1 to 32 and grouped according to which pair of stories each participant had to read and retell. The recorded gestures were split into the future and the past,

regarding if they retold the future or past orientated stories, and then coded according to which axis the participants referred to (either the lateral, sagittal or vertical), and towards what direction the future and the past lies (e.g. future towards the front and past towards the back). In this regard, the future or the past could be towards the left or the right, or away towards or behind the body. Additionally, handedness was also coded, in other words the dominant hand of each participant was recorded, and then what hand they would use when talking about the future or the past (e.g. participant 31 used the left hand for the past and the right hand for the future, while anchoring his gestures on the lateral axis). It was also taken note of how the eyes and eyebrows behaved in addition to the speech and gestures.

The data was then analysed by calculating percentages overall, looking at which axis was predominantly used when participants gestured about the future and the past. The four groups were analysed in order to see if the use of axis between the four groups (deictic spatial language, deictic non-spatial language, sequential spatial language, and sequential non-spatial language) differed in any way with regards to the axis use, handedness (if the left and/or the right hand was used to gesture about the future and the past), and directionality of placing the future and the past. Lastly, additionally, handedness overall and in the different groups were analysed.

An inter-coder reliability was also established through a process by which another person independently applied the same coding scheme regarding the stories/elicited material. Inter-coder reliability was very high, as the coders coincided in their coding to 93% of the cases.

5. Results

5.1. Deliberate Gestures

5.1.1. Gesture strokes

The gesture strokes were captured in an excel sheet and coded according to the hand(s) used to produce them (left hand, right hand, bimanual), the orientation of the gesture (lateral axis, sagittal axis, vertical axis), and the direction of the gesture (leftward, rightward, away (from body), toward (the body), back (over the shoulder)) (Casasanto & Jasmin, 2012:650). The difference between toward the body and towards the back of the body was made regarding if the hand(s) stayed in front of the body in torso area (regarded as "toward the body"), or if the hand(s) reached towards or over the shoulder to point towards the back of the ego. Of the 128 gestures that the participants produced, all were on the axes of interest and had a stroke direction that could be coded: 20 gestures were anchored laterally (11 leftward, 9 rightward), and 108 gestures were anchored sagittally (54 away, 4 toward, and 50 back).

5.1.1.1. Axis reference

The lateral gestures were all coded as congruent with the lateral mappings of time. The rate of congruent gestures was compared, overall, and as a function of axis (lateral, sagittal) and temporal reference (deictic, sequence). For reference, the deictic temporal reference is in which the ego, or the participant in this case, determines the "now". In the sequence temporal reference, events can be laid out after each other, which forms a temporal series, on which the ego (or the participant) looks, yet does not have to take part in. In figure 1 below, the sagittal axis was referenced 85% of the time when participants anchored their gestures. This is

considerably higher than the 15% of the times when participants anchored their temporal gestures on the lateral axis.

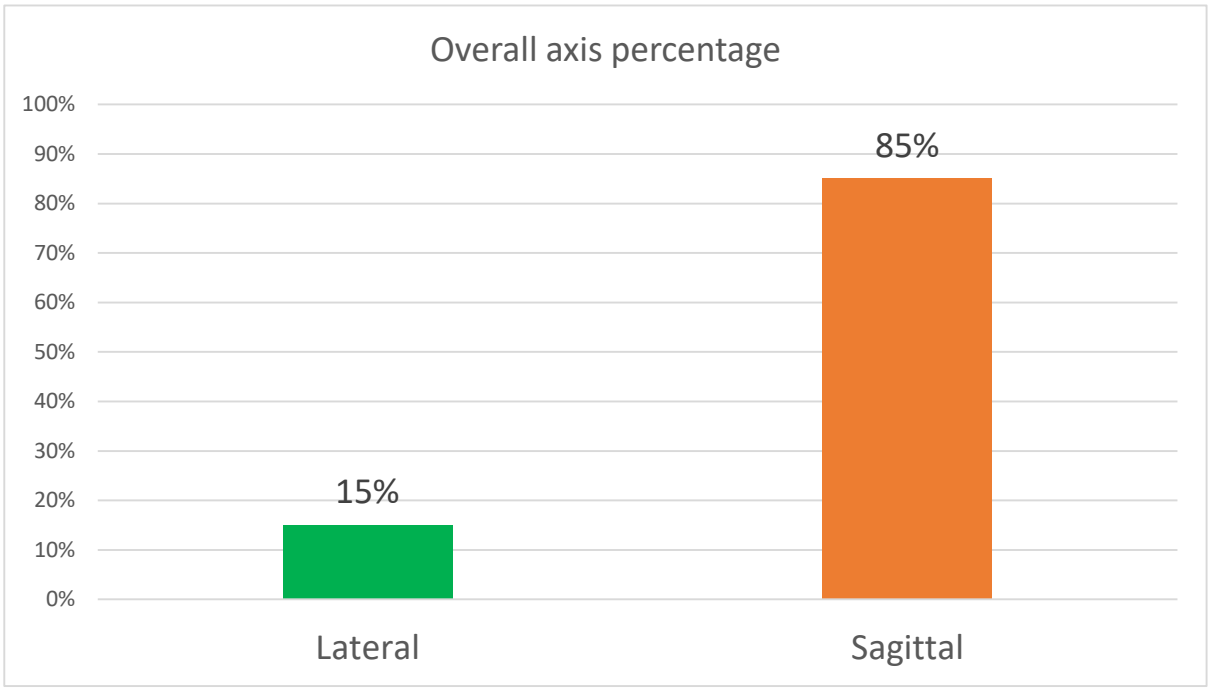

Figure 2: Overall results of experiment. Green bar: Proportion of lateral (left-right) gestures produced, congruent with space-time mappings found in Afrikaans speakers' cultural conventions. Orange bar: Proportion of sagittal (front-back) gestures produced, congruent with space-time mappings found in Afrikaans linguistic metaphors.

5.1.1.2. Temporal reference

In figure 3, the anchoring of the temporal gestures divided into the deictic and the sequence reference is depicted. The anchoring of the temporal gestures on the sagittal axis carry close to the same percentage in both the deictic and the sequence context, with 42% in the deictic reference and 43% in the sequence reference. The participants that anchored their temporal gestures on the lateral axis consequently made up 8% in the deictic reference and 7% in the sequence reference.

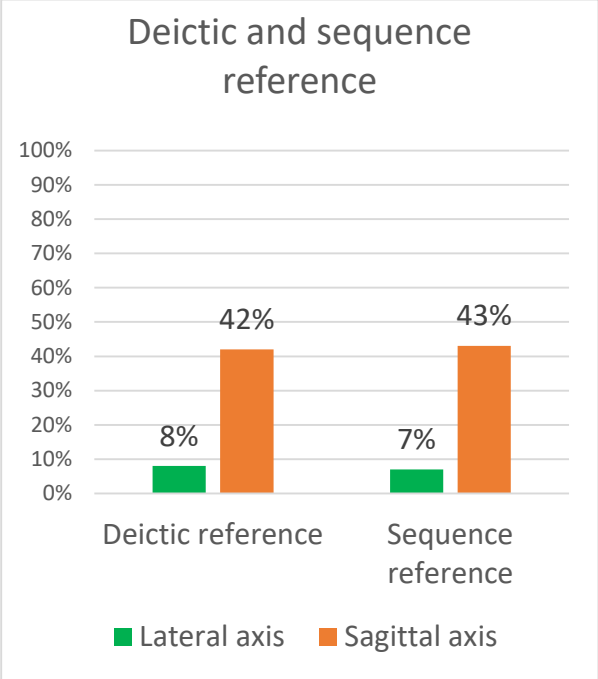

Figure 3: Overall results of experiment regarding the axis reference. Green bars: Proportion of lateral (left-right) gestures congruent with space-time mappings found in Afrikaans speakers' cultural conventions, produced during deictic temporal language (left columns) and sequence-based temporal language (right columns). Orange bars: Proportion of sagittal (front-back) gestures congruent with space-time mappings found in Afrikaans linguistic metaphors, produced during deictic temporal language (left columns) and sequence-based temporal language (right columns).

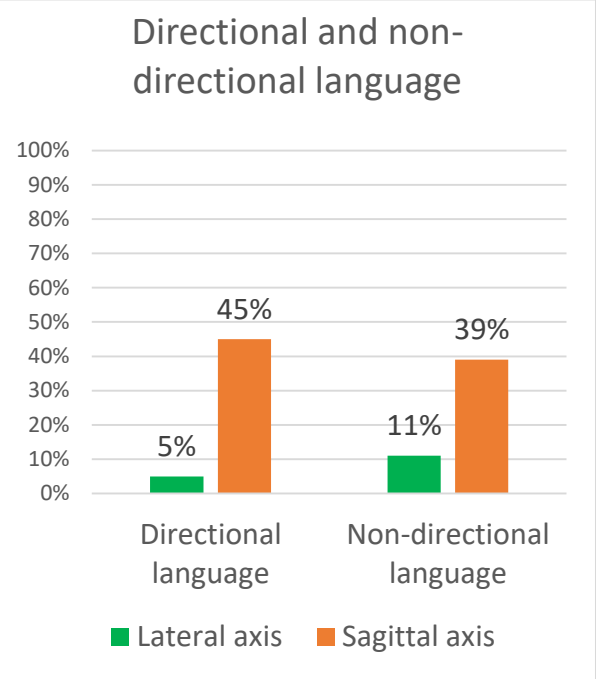

Figure 4: Overall results of experiment regarding the axis reference. Green bars: Proportion of lateral (left-right) gestures congruent with space-time mappings found in Afrikaans speakers' cultural conventions, produced during directional language (left columns) and non-directional language (right columns). Orange bars: Proportion of sagittal (front-back) gestures congruent with space-time mappings found in Afrikaans linguistic metaphors, produced during directional language (left columns) and non-directional language (right columns).

Overall, 85% of the participants in both temporal references gestured on the sagittal axis (42% away, 3% toward, 40% back). The chi-squared of the temporal reference and the lateral and sagittal axis equals 0.237 with 1 degree of freedom and holds a p-value of 0.626354, which shows no statistical significance. This means that the temporal reference had no impact on the participant choosing either to gesture on the lateral or sagittal axis.

5.1.1.3. The use of the left and/or right hand

When looking at the hands used to gesture with for the future or the past, which are combined in these results for now, the following pattern emerged: overall, the left hand was used 23%, the right hand was used 64%, and bimanual gestures occurred 13% of the time. These results can be found split into the future reference and the past reference in figure 4.

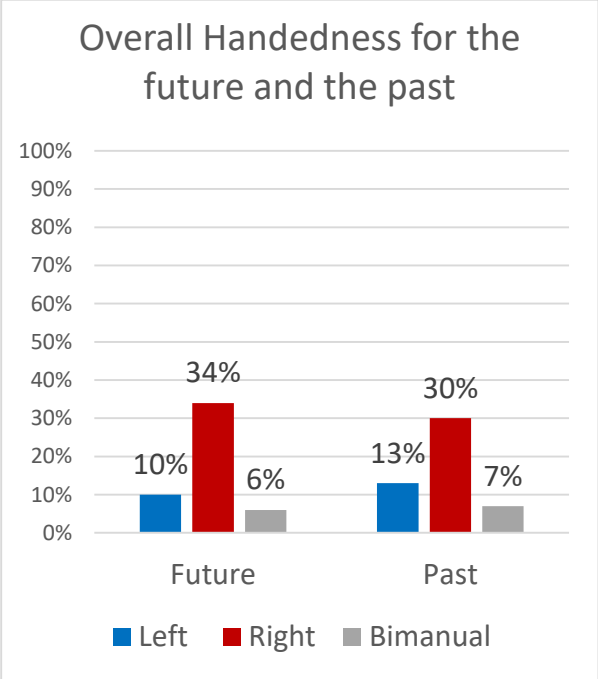

Figure 5: Overall handedness results for the future and the past reference. Blue bars: Proportion of left-handed gestures produced when speaking about the future (left columns), and the past (right columns). Red bars: Proportion of right-handed gestures produced when speaking about the future (left columns), and the past (right columns). Grey bars: Proportion of bimanual gestures produced when speaking about the future (left columns), and the past (right columns).

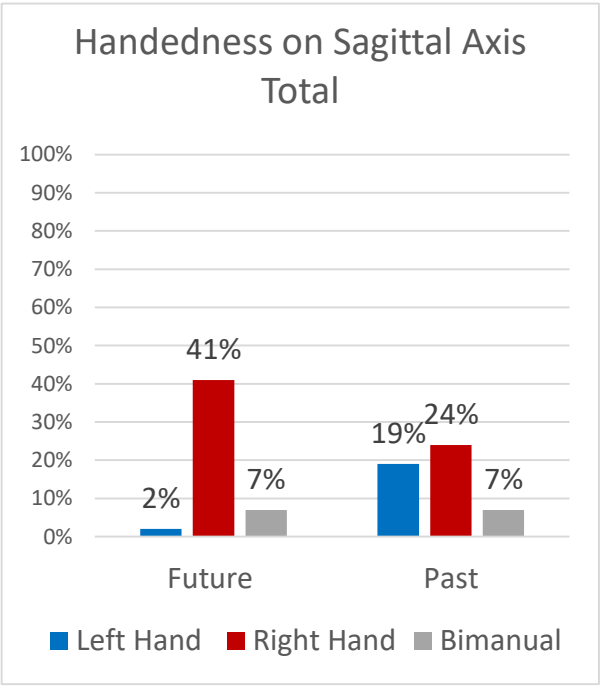

Figure 6: Hands used on the sagittal axis for the future and the past. Blue bars: Percentage of left hand used to gesture for the future (left columns) and past (right columns). Red bars: Percentage of right hand used to gesture for the future (left columns) and past (right columns). Grey bars: Percentage of both hands used to gesture for the future (left columns) and past (right columns).

In further detail regarding figure 4, for the future, the left hand was used 10%, the right hand was used 34%, and both hands were used 6%. For the past, the left hand was used 13%, the right hand 30%, and both hands were used 7%.

When looking at the graphical depiction of the hands used to gesture for the past and the future only on the sagittal axis, it can be seen, that this handedness pattern still stands out: the left hand

is majorly used to gesture for the past, and the right hand is used to gesture for the future (figure 6). Specifically, the left hand is used for the past 19%, while the right hand is used almost twice as much, 41%, for the future. The general chi-squared for handedness on the sagittal axis used to gesture with for the future and the past in this regard equals 18.8644 with 1 degree of freedom and a p-value of 0.00008, while the chi-squared of only the left hand, the right hand, the future, and the past is 18.781 with 1 degree of freedom and a statistical significance of 0.000015. In both cases, the results are statistically significant at ($p<0.5$).

One can take an even deeper look into the hands used to gesture for the future and the past in the different temporal references. When speaking about temporal references division, then the temporal references are referring to the deictic and sequential reference, of which the former is where the ego determines the "now", and the latter is where certain events can be chained together forming a temporal series, in which the ego can look, but does not have to take part. Overall, when participants gestured about the past, even though the right hand was used 9% more than the left hand in the deictic reference, the left hand was used 4% more when participants gestured in the sequence temporal reference condition. Looking at the future, the use of the right hand outnumbered the use of the left hand, both in the deictic and sequence reference condition. Furthermore, there cannot be seen a preference regarding the right hand used to gesture in the deictic and sequence referenced questions. The bimanual gestures showed no significant difference ($p > 0.1$) when applied for the future and the past in the deictic and sequence reference.

After having looked at the temporal reference above, we now turn to examine the similarities between the temporal gestures produced when primed with spatial or non-spatial metaphorical language. At the first glance it becomes clear that the percentages of gestures produced in the spatial and non-spatial metaphorical conditions are the same for gestures for the past, where left hand (with 9% in both conditions), right hand (with 13% in both conditions) and bimanual hand use (with 3% in both conditions) is concerned. The use of the left hand versus the use of the right hand are close in their percentages, with the right hand carrying more weight. Moving over to the hands used when gesturing about the future, the right hand carries the highest percentage, with 23% in the spatial metaphors condition.

Overall, with the data elicited in experiment 1, it becomes clear that the sagittal axis was predominantly used to anchor temporal gestures amongst Afrikaans speakers, showing no difference between the different conditions. An additional, important finding was that of the use of hands for the future and the past on this axis, in the sense that a correlation between the left hand and the past, and the right hand and the future was found[1].

5.2. Spontaneous gestures

In this section, experiment 2, which investigated spontaneous gestures by asking participants to retell prewritten short stories, is reported on. A comparison between the temporal language used to prime the participants and the temporal language participants produced in their speech will be given. Further along the line, the gestural behaviour along with the speech will be considered, in which special cases involving eye and brow movement will be specified. Lastly, also in this experiment, the handedness of the participants when gesturing about time will be delved into.

5.2.1. Temporal language comparison

Below, the spatio-temporal metaphors supplied in the prewritten stories, established by the investigator, and the spatio-temporal metaphors produced in speech by the participants will be presented. A pattern appears, regarding frequent use of a specific metaphor spoken compared to the metaphors used in the stories to prime the participant. The stories can be found in Addendum H.

5.2.1.1. Spatio-temporal metaphors used in stories

The stories for this experiment were created out of imagination. In total, there are four different kinds of stories, each having their own, individual narrative. Two of them have a pastward narrative line (i.e. the story progresses backwards in time), while the two others have a futureward narrative line (i.e. the story progresses ahead in time). Half of these stories used

[1] All participants were right-handed and therefore gave no comparison on how left-handed people would gesture about time. This was done intentionally, in order to not bias the data with handedness being a confounding factor (Casasanto & Lupyan, 2015:22-24). The one participant that was left-handed and whose data was captured, but excluded from the statistics, fell into the majority group, who anchored their gesture onto the sagittal axis, with the future lying ahead and the past lying behind the ego.

deictic temporal reference. The other half used a sequence temporal reference, which can be understood as the reference being separate from the deictic now point in time. From the four stories, two versions of each story were created, one using spatio-temporal metaphors and the other two using non-spatial metaphors. The layout of the temporal language of the stories is given for comparative purposes between the spatio-temporal phrases given in the stories (table 2), and the spatio-temporal phrases uttered during the experiment (table 3).

Table 2: Spatio-temporal metaphors used in stories

	Future		**Past**	
	Afrikaans	**English translation**	**Afrikaans**	**English translation**
Deictic temporal reference Spatio-temporal metaphors	*nabye toekoms*	in the near future	*destyds*	way back then
	met die oog op die toekoms	with the eye on the future	*gister*	yesterday
	môre	tomorrow	*baie jare gelede*	many years back
	'n lang tyd van nou af	a long time from now	*om terug te gaan in tyd*	to go back in time
Deictic temporal reference Non-spatial metaphors	*binnekort*	soon	*lank gelede*	long time ago
	in die verre toekoms	in the distant future	*gister*	yesterday
	môre	tomorrow	*baie jare gelede*	many years ago
	'n lang tyd van nou af	long time from now	*vroeër*	earlier
Sequence temporal reference Spatio-temporal metaphors	*vooruit kyk na die toekoms*	looking ahead into the future	*jou pa se generasie*	your dad's generation
	oor 'n paar dae	in a few days' time	*jou oupa se generasie*	your grandfather's generation
	twee weke wat kom	two weeks coming	*jou oupa se generasie voor dit*	your grandfather's generation before that
	as jy vooruit dink	thinking ahead	*destyds toe*	way back then
	eendag aan jou kinders kan gee	give to your children one day	*om terug te beweeg in tyd*	move back in time
	hul kinders	their children		
	in die nabye toekoms	in the near future	*jou pa se generasie*	your dad's generation

Sequence temporal reference Non-spatial metaphors	*oor 'n paar dae*	in a few days' time	*jou oupa se generasie*	your grandfather's generation
	volgende twee weke	next two weeks	*jou oupa-grootjie se generasie voor dit*	your great-grandfather's generation before that
	binne die volgende paar dae	next few days	*verre verlede*	distant past
	aan jou kinders kan gee	give to your children one day	*in 'n vroeër tyd kon geleef het*	have lived earlier in time
	hul kinders	their children		

5.2.1.2. Spoken spatio-temporal metaphors and phrases

In this section, the spoken temporal language produced by the participants will be presented in the table below (table 2). Every spoken temporal reference was taken note of, even if it was not accompanied by a gesture. The spoken temporal language compared to the temporal language in the stories overlap but are not identical. They, however, still carry meaning and were coded if they were accompanied by a gesture. An English translation of the spoken temporal language will be given, and repetitions of the same word or phrase in one group will be grouped together.

Table 3: Spatio-temporal metaphors spoken in retold stories

	Future		**Past**	
	Afrikaans	**English translation**	***Afrikaans***	**English translation**
Deictic temporal reference Spatio-temporal metaphors	*(in die nabye) toekoms*	(in the near) future	*(in die) verlede*	(in the) past
	binnekort	soon	*(lank) terug*	(long) ago
	oor 'n paar dae	In a few days	*jare gelede*	years back
	vooruit (kyk)	(looking) ahead	*terug (gaan)*	(go) back
Deictic temporal reference Non-spatial metaphors	*binnekort*	soon	*(in die) verlede*	(in the) past
	(in die verde) toekoms	in the far future	*gister*	yesterday
	môre	tomorrow	*toe ek jonger was*	when I was younger
	een dag	one day		
Sequence temporal reference Spatio-temporal metaphors	*vooruit/voorantoe na die toekoms*	forward/ahead in the future	*my pa se generasie*	my dad's generation
	oor/binne 'n paar dae	in a few days' time	*my oupa se generasie*	my grandfather's generation

			my oupa-grootjie	my great-grandfather
	volgende twee weke	coming two weeks	*sy oupa se generasie (voor dit)*	his grandfather's generation (before that)
	vooruit dink	thinking ahead	*destyds toe*	way back then
	my kinders gee	give to my children	*terug gaan*	go back
	kinders se kinders	children's children	*daai tyd*	that time
			in die verlede	in the past
Sequence temporal reference Non-spatial metaphors	*in die nabye toekoms*	in the near future	*my pa se generasie*	my dad's generation
	oor 'n paar dae	in a few days' time	*my oupa se generasie*	my grandfather's generation
	volgende twee weke	next two weeks	*sy pa se generasie*	his dad's generation
	binne die volgende paar dae	next few days	*generasie voor hom*	generation before him
	aan jou kinders kan gee	give to your children one day	*hulle dae*	their days
	hul kinders	their children	*in die vroeër verlede*	in the early past
			terug gaan	go back
			toe ek jonger was	when I was younger
			ou dae	old days

Having the temporal language in the prewritten stories and the temporal language that occurred in speech laid out, it is seen that participants retained the stories easily and gave back nearly always the temporal language that was given in the stories. Overall for the future-referenced stories, 16 of the 20 temporal phrases were given back in speech, when the participants had to retell the stories, either word for word, or a very close approximation of the temporal phrase given in the stories. For the past, it came together to 12 out of the 18 phrases. The rest of the phrases were completely altered word for word and did not correspond to the condition that they occurred in, or they were just completely paraphrased, yet still applicable to be recorded with the temporal gestures produced.

5.2.2. Gestural behaviour and speech analysis

Below, the temporal gestures produced while participants retold the stories will be represented in detail. When speaking about temporal gestures, not only the use of hands is referred to, but also the head movements, which usually either coincide with hand movements, or occur on their own.

5.2.2.1. General results

All gesture types were captured in an excel sheet and coded according to whether the hand or the head was used to produce them (left hand, right hand, bimanual, head), the orientation (lateral axis, sagittal axis, vertical axis), and the direction (leftward, rightward, away (from body), toward (the body), back (over the shoulder) (Casasanto & Jasmin, 2012:650). The difference between toward the body and towards the back of the body was made if the hand(s) stayed in front of the body in torso area, or if the hand(s) reached towards or over the shoulder to point towards the back of the ego. Columns were reserved to take notes regarding additional information about significant movement of the eyes and brows, or if the gesture itself showed any special attribute regarding alignment with speech or non-correspondence with the traditional flow of time in Afrikaans (i.e. if the past appears to be mapped to the right side of the space, or if the future appears to be mapped to the left side of space). Of the 123 gestures that the participants produced, all were on the axis of interest and had a stroke direction that could be coded: 55 gestures were anchored laterally (33 leftward, 22 rightward), and 68 gestures were anchored sagittally (47 away, 10 toward, and 11 back).

When looking at the alignment between the temporal gestures and the temporal language produced, 8 gestures of the overall 123 gestures produced preceded the speech containing the temporal language that was coproduced with the occurring temporal gesture.

5.2.2.2. Axis

The spatial anchoring of time that participants displayed followed either the lateral axis. Although, all participants gestured on the axis of interest, which was either the lateral or the sagittal axis, not all gestures were congruent with the flow of either the reading-writing direction, or the spatio-temporal metaphors found in Afrikaans. The results follow below.

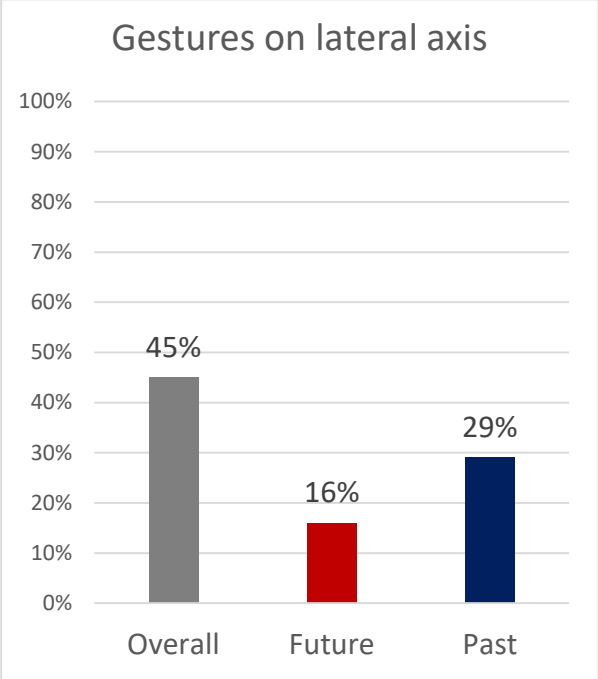

Figure 7: Temporal gestures anchored on the lateral axis. Grey bar: Overall laterally anchored gestures. Red bar: Future orientated laterally anchored gestures. Blue bar: Past orientated laterally anchored gestures.

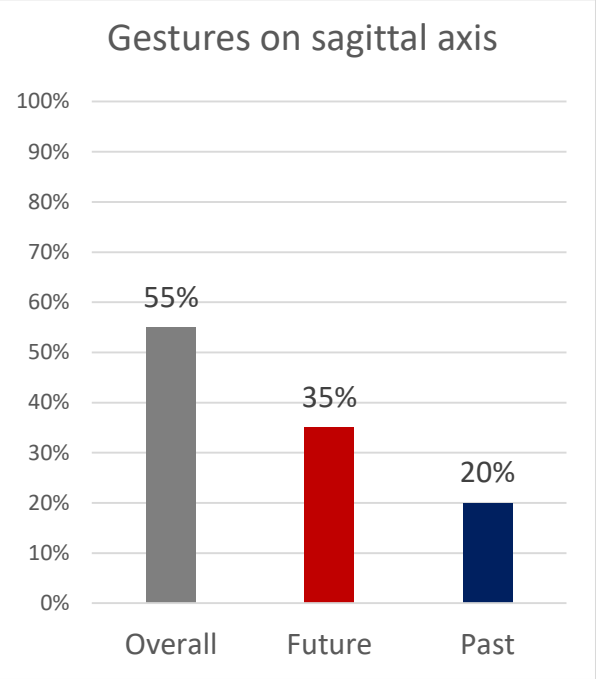

Figure 8: Temporal gestures anchored on the sagittal axis. Grey bar: Overall sagitally anchored gestures. Red bar: Future orientated sagitally anchored gestures. Blue bar: Past orientated sagitally anchored gestures.

The investigation into spontaneous gestures shows that 45% of the overall gestures were anchored on the lateral axis (figure 7), and 55% of the temporal gestures were anchored on the sagittal axis (figure 8).

These graphs give a better overview of the temporal gestures produced for the future and the past (figure 7 and 8). Slightly more gestures were produced for the future than the past, with 51% of the overall gestures were for the future, and 49% for the past. Having a look at the anchoring of the gestures on the lateral and the sagittal axis, more gestures for the future

reference were anchored on the sagittal axis (55%), where for the past reference, the majority of the temporal gestures were anchored on the lateral axis (29%).

5.2.2.2.1. Gestures produced on the lateral axis

When delving deeper into the results, it is also necessary to a closer examination to the division between the deictic temporal reference condition and sequence temporal reference condition regarding the lateral axis, in order to obtain knowledge regarding the influence that the different conditions have on the participants anchoring their temporal gestures onto the lateral axis. The deictic temporal reference, which carried 8% of the temporal gestures anchored on the lateral axis, is in which the participant, also the ego, was the reference point for the "now" (figure 9). In the sequence temporal reference, in which the ego was the observer of events, the lateral axis was used to anchor the temporal gestures significantly more at 37% (figure 10).

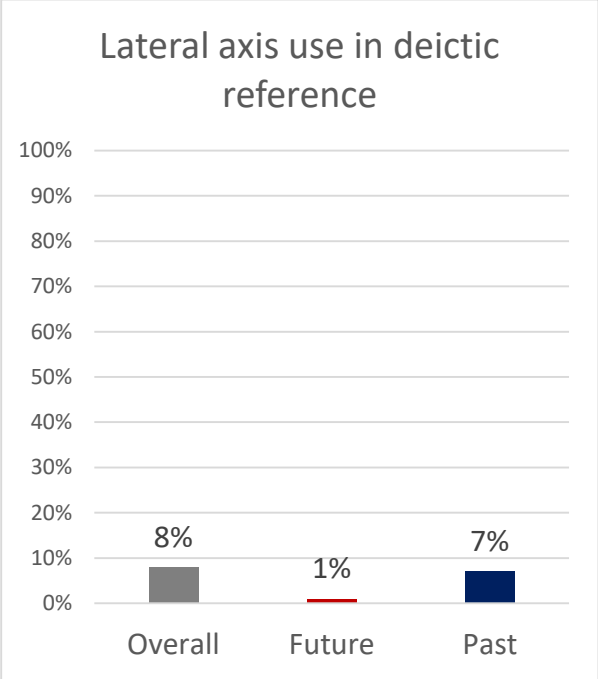

Figure 9: Temporal gestures anchored on the lateral axis in the deictic temporal reference point. Grey bar: Overall laterally anchored gestures produced in the deictic reference point. Red bar: Future orientated laterally anchored gestures produced in the deictic reference point. Blue bar: Past orientated laterally anchored gestures produced in the deictic reference point

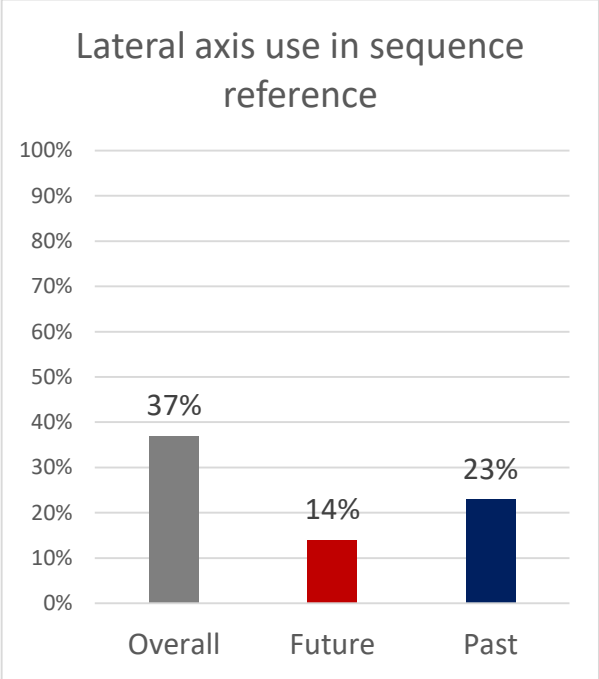

Figure 10: Temporal gestures anchored on the lateral axis in the sequence temporal reference point. Grey bar: Overall laterally anchored gestures produced in the sequence reference point. Red bar: Future orientated laterally anchored gestures produced in the sequence reference point. Blue bar: Past orientated laterally anchored gestures produced in the sequence reference point.

Only 1% within the 8% of the participants that anchored their gestures onto the lateral axis in the deictic temporal reference did so when gesturing about the future, and the rest did so when gesturing for the past (figure 9). Within the overall 37% that anchored their temporal gestures onto the lateral axis, 14% did so for the future and 23% did so for the past (figure 10).

Now, moving onto the use of spatio-temporal metaphors and non-spatio-temporal metaphors, a differentiation can be drawn between the temporal language used to prime the participants, and the gestures they produced on the lateral axis. The overall 45% of the temporal gestures anchored onto the lateral axis can also be divided into gestures produced when primed in the spatial language condition and gestures produced in the non-spatial language. For the former, 22% of the participants anchored their temporal gestures onto the lateral axis (figure 11), and 23% in the latter (figure 12).

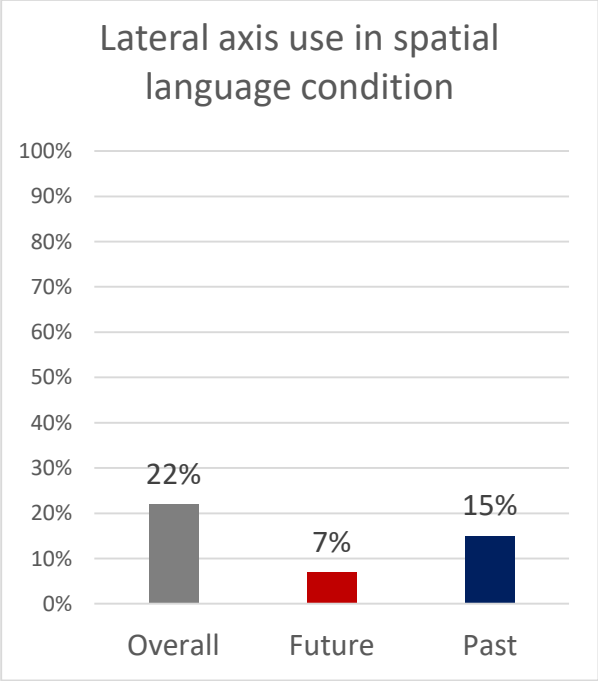

Figure 11: Temporal gestures anchored on the lateral axis in the spatial language condition. Grey bar: Overall laterally anchored gestures produced in the spatial language condition. Red bar: Future orientated laterally anchored gestures produced in the spatial language condition. Blue bar: Past orientated laterally anchored gestures produced in the spatial language condition.

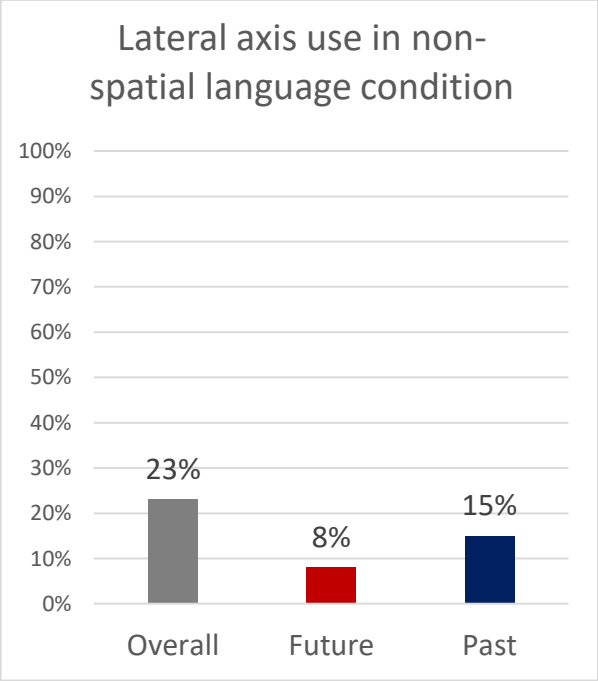

Figure 12: Temporal gestures anchored on the lateral axis in the non-spatial language condition. Grey bar: Overall laterally anchored gestures produced in the non-spatial language condition. Red bar: Future orientated laterally anchored gestures produced in the non-spatial language condition. Blue bar: Past orientated laterally anchored gestures produced in the non-spatial language condition.

Once again, dividing the laterally anchored temporal gestures that the participants produced, the overall 45% of all the laterally anchored gestures can be further specified into the gestures produced for the future and the past. In the 22% of the gestures produced in the spatial metaphoric use of language, 7% of the gestures referred to the future and 15% referred to the

past (figure 11). In the non-spatial metaphoric language condition, 8% anchored their gestures on the lateral axis when they referred to the future, and 15% when referring to the past (figure 12).

5.2.2.2.2. Gestures congruent with reading-writing direction

Overall, 81% of the temporal gestures produced were congruent with the either the reading and writing direction on the lateral axis (this section), or with the spatio-temporal metaphors on the sagittal axis (section 5.2.2.2.4 Gestures congruent with spatio-temporal metaphors). In this section, the congruency between the lateral axis and the produced temporal gestures will be presented.

In the above section, the different results regarding the laterally anchored gestures were presented, in differing conditions, specified on the deictic and sequence reference, and in the spatial and non-spatial language use. Although all gestures produced on the lateral axis were either to the left or the right, not all of them were congruent with the reading and writing direction, in which the past lies towards the left and the future towards the right. The overall gestures, of the 45% laterally anchored gestures produced, 31% of the 45% were congruent with the reading-writing direction, in which the past was gestured towards the left and the future was gestured towards the right.

Looking at the congruency between the temporal gestures and reading-writing direction, in the deictic and sequence reference conditions, the gestures in the deictic condition sank by 2% (figure 13) and in the sequence reference condition sank by 12% (figure 14). Going into more detail, the 2% decrease in the deictic reference in gestures that were congruent with the reading and writing direction, occurred in the reference towards the past only (figure 13). Of the 12% decrease in the sequence reference condition, the 5% decrease occurred in the future reference and 7% in the past reference (figure 14).

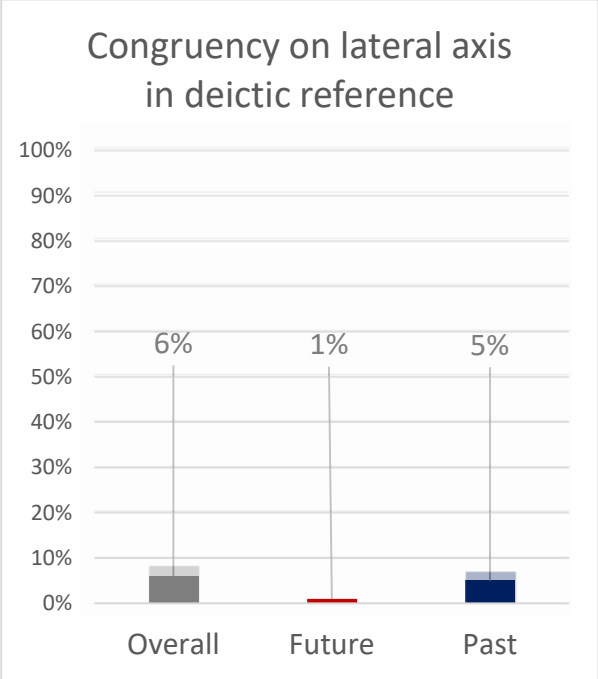

Figure 13: Congruent temporal gestures anchored on the lateral axis in the deictic temporal reference. The faded bars seen rising above the solid color bars represent the overall gestures anchored on the lateral axis in the deictic temporal reference. These can be found in figure 9. Grey bar: Overall laterally anchored gestures produced in the deictic temporal reference. Red bar: Future orientated laterally anchored gestures produced in the deictic temporal reference. Blue bar: Past orientated laterally anchored gestures produced in the deictic temporal reference.

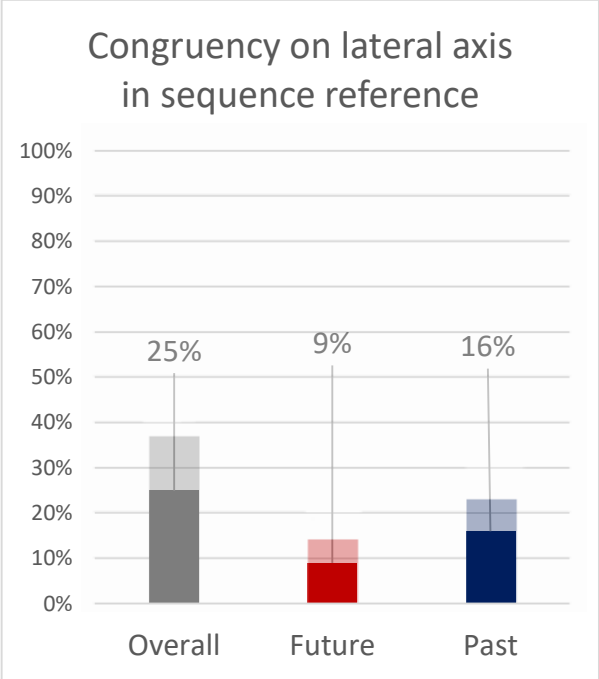

Figure 14: Congruent temporal gestures anchored on the lateral axis in the sequence temporal reference. The faded bars seen rising above the solid color bars represent the overall gestures anchored on the lateral axis in the sequence temporal reference. These can be found in figure 10. Grey bar: Overall laterally anchored gestures produced in the sequence temporal reference. Red bar: Future orientated laterally anchored gestures produced in the sequence temporal reference. Blue bar: Past orientated laterally anchored gestures produced in the sequence temporal reference.

The congruency level between the produced temporal gestures and the reading-writing direction in the conditions where the participants were either primed with spatial or non-spatial metaphoric language, also sank by a few percentages. In the spatial metaphoric language condition, the gestures that were congruent are 8% lower than the overall gestures produced on the lateral axis in this condition (figure 15) and sank by 6% in the non-spatial metaphoric condition (figure 16).

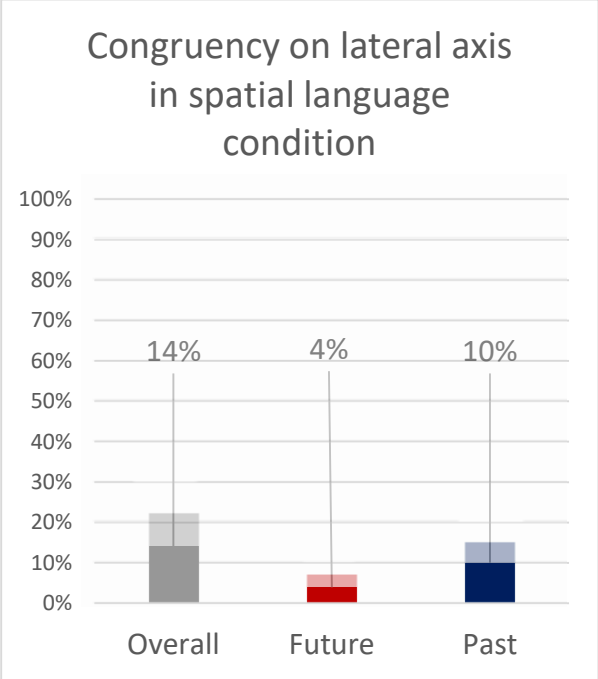

Figure 15: Congruent temporal gestures anchored on the lateral axis in the spatial language condition. The faded bars seen rising above the solid color bars represent the overall gestures anchored on the lateral axis in the spatial language condition. These can be found in figure 11. Grey bar: Overall laterally anchored gestures produced in the spatial language condition. Red bar: Future orientated laterally anchored gestures produced in the spatial language condition. Blue bar: Past orientated laterally anchored gestures produced in the spatial language condition.

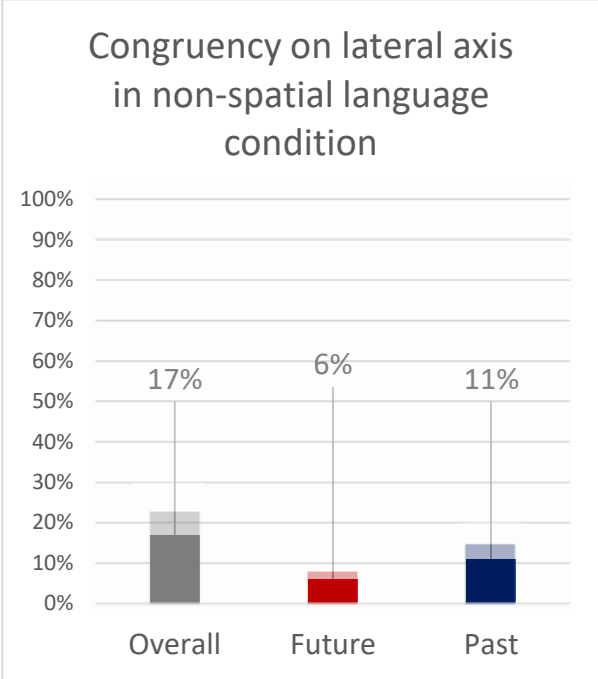

Figure 16: Congruent temporal gestures anchored on the lateral axis in the non-spatial language condition. The faded bars seen rising above the solid color bars represent the overall gestures anchored on the lateral axis in the non-spatial language condition. These can be found in figure 12. Grey bar: Overall laterally anchored gestures produced in the non-spatial language condition. Red bar: Future orientated laterally anchored gestures produced in the non-spatial language condition. Blue bar: Past orientated laterally anchored gestures produced in the non-spatial language condition.

Of the 8% that sank in the spatial metaphoric language, there was a 3% decrease in the gestures produced when referencing for the future, and a 5% decrease when referencing for the past (figure 15). In the non-spatial metaphoric language condition, the 6% decrease was divided into 2% decrease for the future and 4% decrease for the past reference (figure 16).

5.2.2.2.3. Gestures produced on the sagittal axis

Temporal gestures anchored on the sagittal axis made up 55% of the overall gestures produced, which is 10% more than the temporal gestures anchored on the lateral axis. The 55% is split into, and looked at, the deictic reference, which made up 20%, and the sequence reference, which is 35%. The comparison between the two axes and the temporal references carries a chi-squared of 5.1577 and a p-value of 0.023144. Even though, more gestures have been produced on the sagittal axis in the sequence temporal reference condition, no significance was found at $p < 0.01$. In other words, the different temporal reference conditions did not impact what axis the participants used to anchor their temporal gestures.

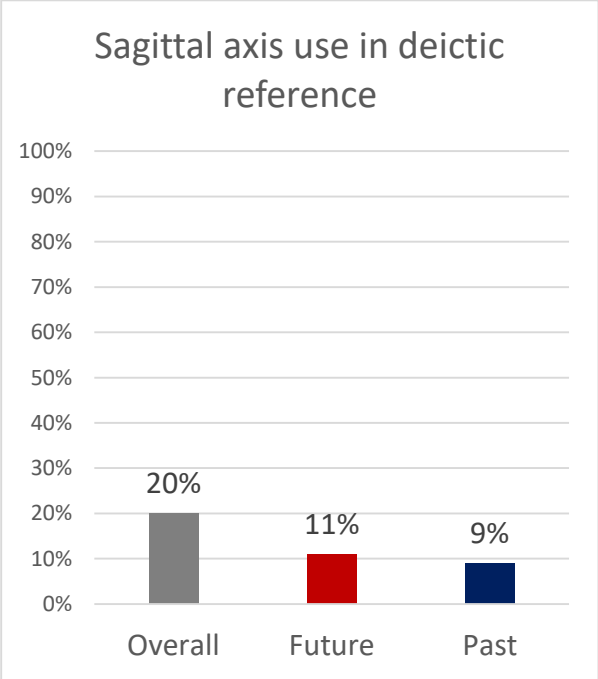

Figure 17: Temporal gestures anchored on the sagittal axis in the deictic temporal reference. Grey bar: Overall laterally anchored gestures produced in the deictic temporal reference. Red bar: Future orientated laterally anchored gestures produced in the deictic temporal reference. Blue bar: Past orientated laterally anchored gestures produced in the deictic temporal reference.

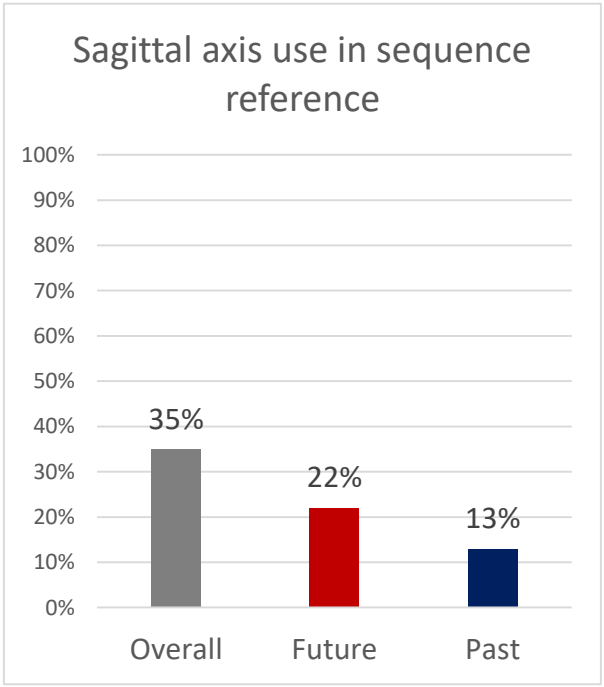

Figure 18: Temporal gestures anchored on the sagittal axis in the sequence temporal reference. Grey bar: Overall laterally anchored gestures produced in the sequence temporal reference. Red bar: Future orientated laterally anchored gestures produced in the sequence temporal reference. Blue bar: Past orientated laterally anchored gestures produced in the sequence temporal reference.

Getting into more detail, we can look at how the gestural reference for the future and the past are distributed in the deictic temporal reference and the sequence temporal reference. Overall,

the most gestures were produced for the future reference in the sequence temporal reference condition (figure 18). Following onto that percentage, is the anchoring of the temporal gestures in the sequence temporal reference when gesturing about the past with 13% (figure 18), and lastly, the deictic reference conditioning with the reference for the future and the past follow (figure 18).

The data can also be divided into the conditions of spatial language and non-spatial language used. The results show that gestures produced on the sagittal axis occurred more in the condition in which spatial language was used (figure 19), than in the condition in which non-spatial language was used (figure 20).

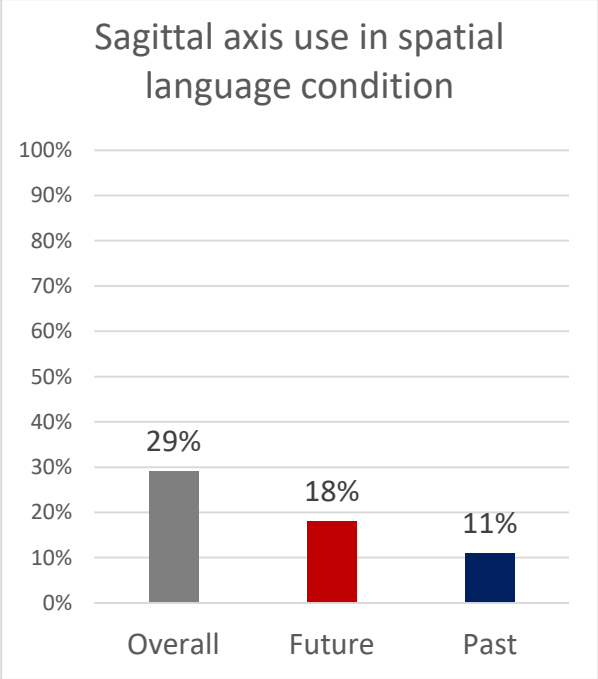

Figure 19: Temporal gestures anchored on the sagittal axis in the spatial language condition. Grey bar: Overall laterally anchored gestures produced in the spatial language condition. Red bar: Future orientated laterally anchored gestures produced in the spatial language condition. Blue bar: Past orientated laterally anchored gestures produced in the spatial language condition.

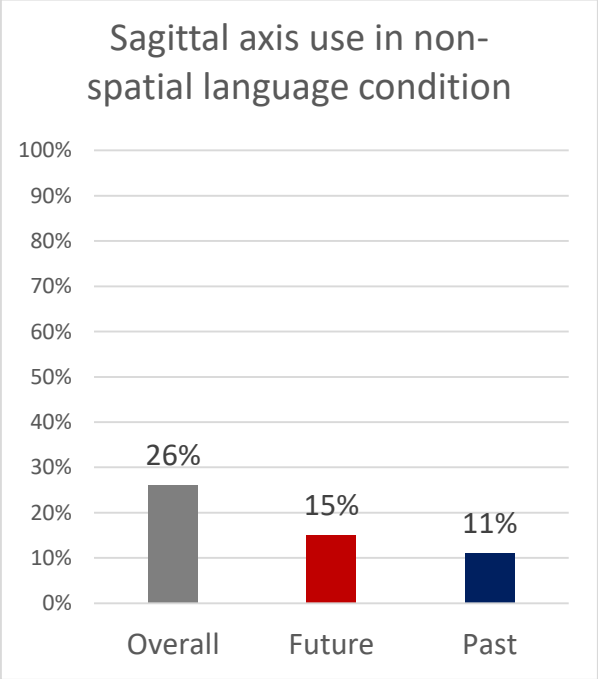

Figure 20: Temporal gestures anchored on the sagittal axis in the non-spatial language condition. Grey bar: Overall laterally anchored gestures produced in the non-spatial language condition. Red bar: Future orientated laterally anchored gestures produced in the non-spatial language condition. Blue bar: Past orientated laterally anchored gestures produced in the non-spatial language condition.

The gestures produced in the spatial language condition and in the non-spatial condition can be further detailed into the future reference and the past reference. Overall, sagitally anchored gestures that were produced when referring to the future differ slightly between these two conditions, of which 18% were produced in the spatial language condition (figure 19), and 15% in the non-spatial condition (figure 20). For the past, interestingly, for both the spatial language and the non-spatial language, the same amount of gestures was produced when participants anchored their temporal gestures onto the sagittal axis.

5.2.2.2.4. Gestures congruent with spatio-temporal metaphors

As explained above, the sagitally anchored gestures outweigh the laterally anchored gestures, yet not all of them follow the sagitally flowing mental timeline that is determined by the spatio-temporal metaphors found in Afrikaans. In other words, even though the temporal gestures were produced on the sagittal axis, not all of them were congruent with the spatio-temporal metaphors, which determine the future to be lying ahead of the ego and the past towards the back of the ego. Below, the congruency in all conditions, collapsed and expanded for the future and the past, are portrayed.

Examining the difference between the deictic temporal reference and the sequence temporal reference, it was found that the gestures that were congruent with the spatio-temporal metaphors produced by the participants were at 19% (figure 21), which is 1% lower than the overall temporal gestures produced on the sagittal axis. The temporal gestures produced in the sequence reference, were 4% lower than the overall gestures produced on the sagittal axis (figure 22). Even though the differences are very small, it is still necessary to have looked at the different conditions, and if they indeed had an impact on the congruent gestures anchored onto the sagittal axis.

In more detail regarding the gestural reference for the future and the past, no decrease in gestures produced in the overall gestures produced for the future reference was found. In other words, all gestures that the participants formed for the future in the deictic and the sequence reference were aligned with the spatio-temporal metaphors used in Afrikaans. For the past, however, a decrease was found in both the deictic and sequence reference, of which the former dropped by 1% (figure 21) and the latter by 4% (figure 22).

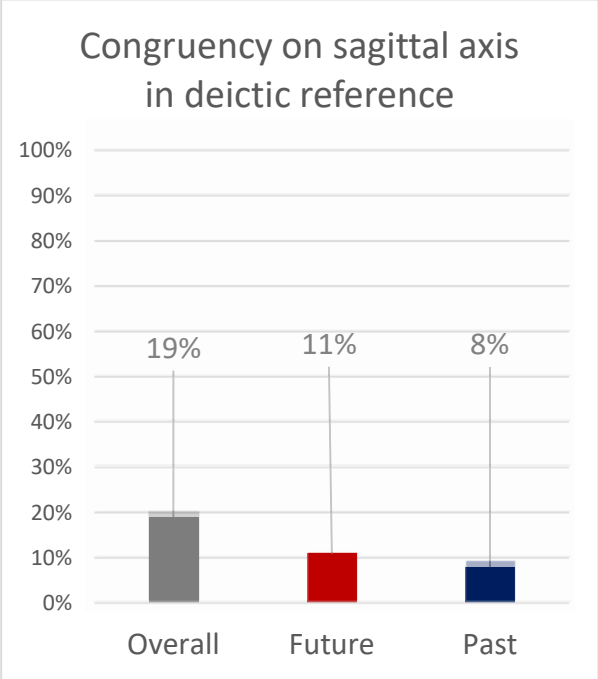

Figure 21: Congruent temporal gestures anchored on the sagittal axis in the deictic temporal reference. The faded bars seen rising above the solid colour bars represent the overall gestures anchored on the sagittal axis in the deictic temporal reference. These can be found in figure 17. Grey bar: Overall sagitally anchored gestures produced in the deictic temporal reference. Red bar: Future orientated sagitally anchored gestures produced in the deictic temporal reference. Blue bar: Past orientated sagitally anchored gestures produced in the deictic temporal reference.

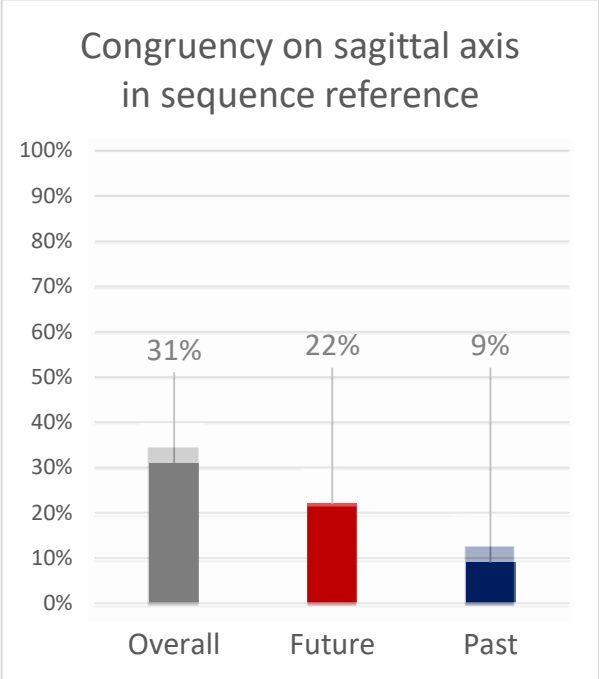

Figure 22: Congruent temporal gestures anchored on the sagittal axis in the sequence temporal reference. The faded bars seen rising above the solid colour bars represent the overall gestures anchored on the sagittal axis in the sequence temporal reference. These can be found in figure 18. Grey bar: Overall sagitally anchored gestures produced in the sequence temporal reference. Red bar: Future orientated sagitally anchored gestures produced in the sequence temporal reference. Blue bar: Past orientated sagitally anchored gestures produced in the sequence temporal reference.

One can also look at it from the spatial language point of view. The two conditions, the participants that were primed in the spatial language condition and the participants that were primed in the non-spatial language condition, differed by only 2%. This again, as before in the deictic and sequence temporal reference condition, the percentages are small, but still need to be considered to see if a correlation between conditions and the anchoring of temporal gestures onto the sagittal axis exists. In the condition in which spatial language was used, the temporal gestures that were congruent with the spatio-temporal metaphors were 3% lower than the overall temporal gestures that occurred (figure 23). The temporal gestures that were congruent

with the spatio-temporal metaphors in the non-spatial language condition were 2% lower than the overall temporal gestures produced (figure 24).

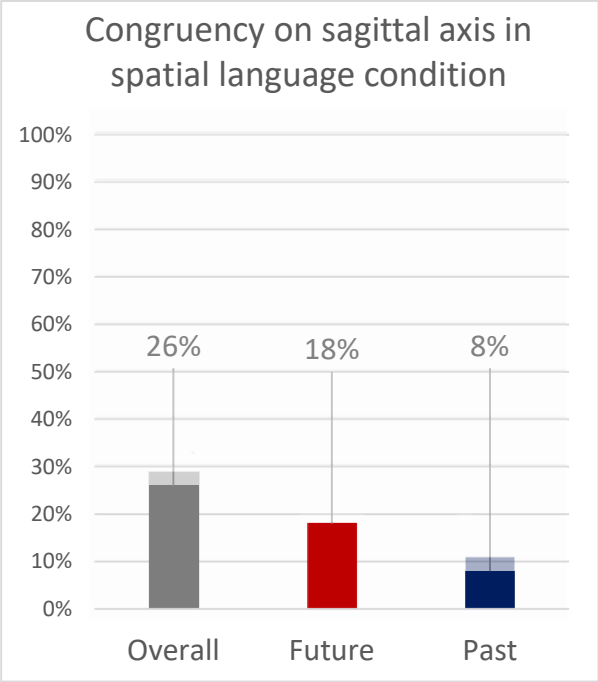

Figure 23: Congruent temporal gestures anchored on the sagittal axis in the spatial language condition. The faded bars seen rising above the solid color bars represent the overall gestures anchored on the sagittal axis in the spatial language condition. These can be found in figure 19. Grey bar: Overall sagitally anchored gestures produced in the spatial language condition. Red bar: Future orientated sagitally anchored gestures produced in the spatial language condition. Blue bar: Past orientated sagitally anchored gestures produced in the spatial language condition.

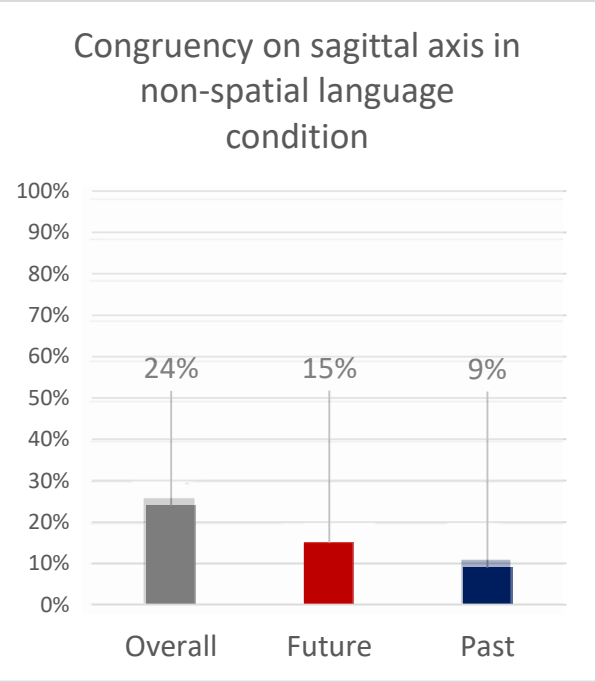

Figure 24: Congruent temporal gestures anchored on the sagittal axis in the non-spatial language condition. The faded bars seen rising above the solid color bars represent the overall gestures anchored on the sagittal axis in the non-spatial language condition. These can be found in figure 20. Grey bar: Overall sagitally anchored gestures produced in the non-spatial language condition. Red bar: Future orientated sagitally anchored gestures produced in the non-spatial language condition. Blue bar: Past orientated sagitally anchored gestures produced in the non-spatial language condition.

Delving deeper into detail, we are looking at the division of the congruent temporal gestures on the sagittal axis with reference to the future and the past in the condition in which spatial language, and in the condition in which non-spatial language, was used. This will give further knowledge, if an effect can be seen regarding congruency in these two conditions. As in the deictic and sequence reference condition mentioned in the sections above, there was no decrease

found in the congruent temporal gestures produced compared with the overall gestures produced for the future reference. For the past, the congruent temporal gestures in the spatial language condition were 3% lower than the overall gestures produced (figure 23), and only decreased by 2% in the non-spatial language condition (figure 24).

5.2.2.2.5. Gestures not congruent with either

In the sections up until now, only the overall and congruent temporal gestures produced have been looked at. The decreases of the temporal gestures in the specified conditions were also mentioned and are explained below in figures 25 and 26. The decreases mentioned above, are the non-congruent gestures discussed about below. They will be shown separately with regards to the sagittal axis and the lateral axis. This will portray a well-rounded picture that makes up the overall temporal gestures produced in this experiment.

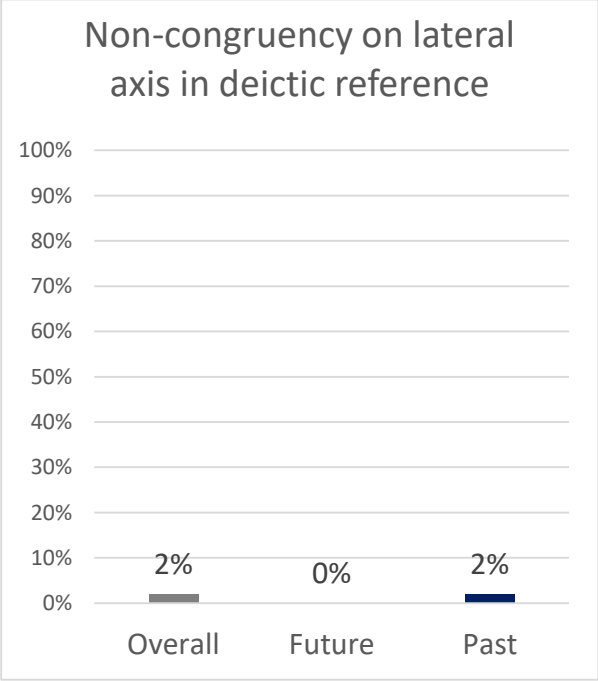

Figure 25: Non-congruent temporal gestures anchored on the lateral axis in the deictic temporal reference. Grey bar: Overall laterally anchored gestures produced in the deictic temporal reference. Red bar: Future orientated laterally anchored gestures produced in the deictic temporal reference. Blue bar: Past orientated laterally anchored gestures produced in the deictic temporal reference.

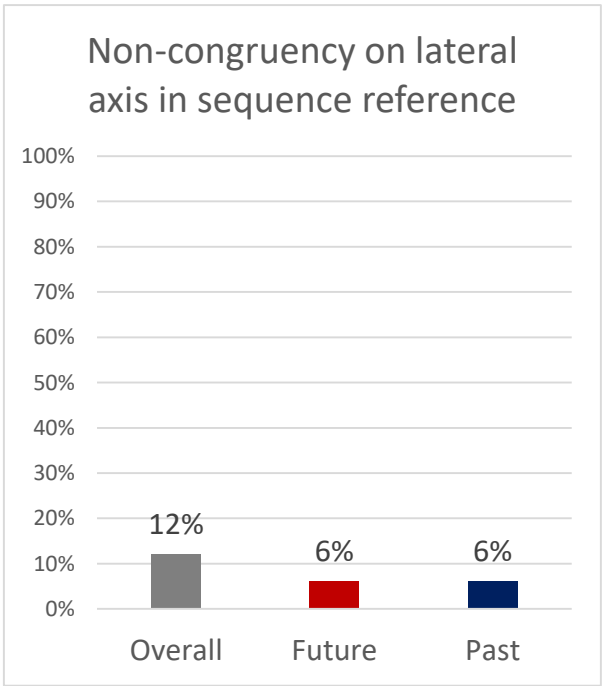

Figure 26: Non-congruent temporal gestures anchored on the lateral axis in the sequence temporal reference. Grey bar: Overall laterally anchored gestures produced in the sequence temporal reference. Red bar: Future orientated laterally anchored gestures produced in the sequence temporal reference. Blue bar: Past orientated laterally anchored gestures produced in the sequence temporal reference.

The contradictory part with regards to the lateral axis, is that participants gestured towards the left for the future and towards the right for the past, which is contradictory to the reading-writing direction found in Afrikaans.

Looking at it in more detail, in the deictic reference condition, there were no non-congruent temporal gestures produced by the participants when referring to the future, but 2% were produced for the past reference (figure 25). In the sequence temporal reference condition, no difference between the future reference and the past reference occurred.

Moving onto the conditions in which either spatial language or non-spatial language was used to prime the participants, only 4% of the overall temporal gestures on the lateral axis in the non-spatial condition were non-congruent, and double that percentage was incongruent in the spatial language condition.

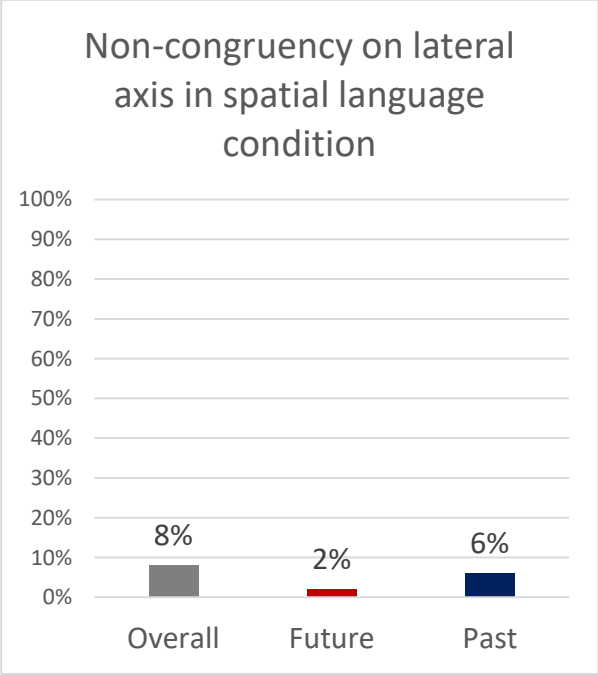

Figure 27: Non-congruent temporal gestures anchored on the lateral axis in the spatial language condition. Grey bar: Overall laterally anchored gestures produced in the spatial language condition. Red bar: Future orientated laterally anchored gestures produced in the spatial language condition. Blue bar: Past orientated laterally anchored gestures produced in the spatial language condition.

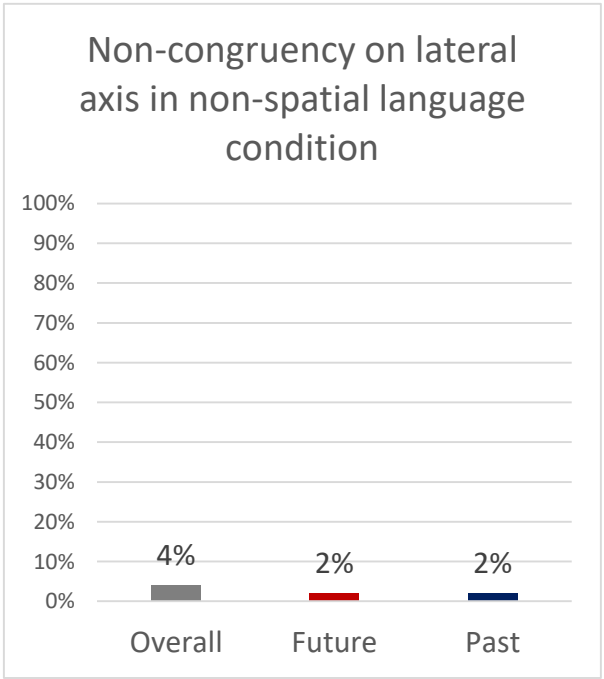

Figure 28: Non-congruent temporal gestures anchored on the lateral axis in the non-spatial language condition. Grey bar: Overall laterally anchored gestures produced in the non-spatial language condition. Red bar: Future orientated laterally anchored gestures produced in the non-spatial language condition. Blue bar: Past orientated laterally anchored gestures produced in the non-spatial language condition.

With regards to participants referring either to the past or the future in the spatial language and the non-spatial language condition, the only outlier in that sense were the non-congruent gestures in the spatial language condition when participants referred to the past. In this instance, 6% produced non-congruent gestures (figure 27). In all the other conditions, both the future and the past, 2% of the participants produced non-congruent temporal gestures, which were anchored on the lateral axis.

The spatio-temporal metaphors, which determine the direction towards which time flows on the sagittal axis, are the determining factor that these temporal gestures are classified as being non-congruent. Below (figure 29 and 30), the division is made between the deictic and the sequence temporal reference conditions, in which only 1% of the overall produced temporal gestures were incongruent with the Afrikaans spatio-temporal metaphors in the deictic temporal reference condition (figure 29). On the other hand, 5% incongruent gestures were produced in the sequence reference condition (figure 30).

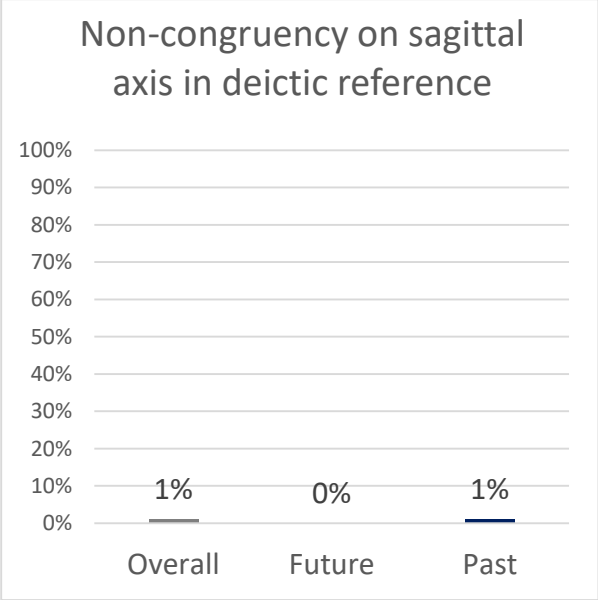

Figure 29: Non-congruent temporal gestures anchored on the sagittal axis in the deictic temporal reference. Grey bar: Overall sagitally anchored gestures produced in the deictic temporal reference. Red bar: Future orientated sagitally anchored gestures produced in the deictic temporal reference. Blue bar: Past orientated sagitally anchored gestures produced in the deictic temporal reference

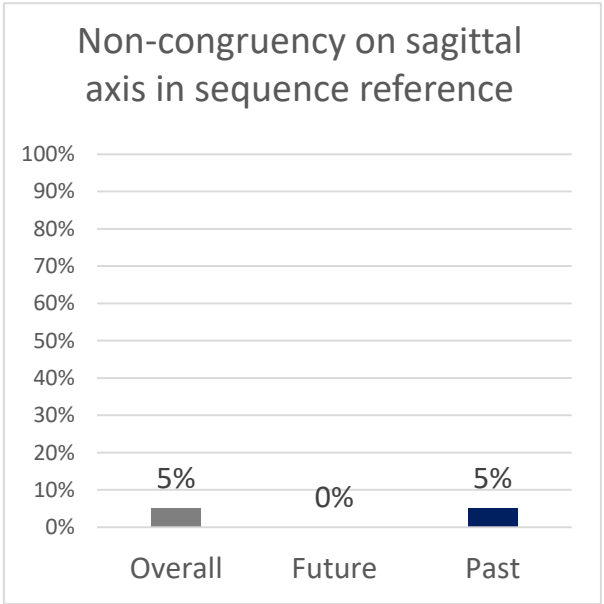

Figure 30: Non-congruent temporal gestures anchored on the sagittal axis in the sequence temporal reference. Grey bar: Overall sagitally anchored gestures produced in the sequence temporal reference. Red bar: Future orientated sagitally anchored gestures produced in the sequence temporal reference. Blue bar: Past orientated sagitally anchored gestures produced in the sequence temporal reference

Interestingly, the 1% found in the deicitc reference condition (figure 29) and the 5% found in the sequence reference condition (figure 30) only occured in the temporal gestures produced for the past. In both conditions, the decitic and sequence temporal reference, 0% of the overall gestures were incongruent when participants referred to the future.

In the conditions in which spatial language and non-spatial language was used, 4% of the overall temporal gestures in the spatial language condition produced were non-congruent with the spatio-temporal metaphors used in Afrikaans (figure 31), and 2% in the non-spatial language condition (figure 32).

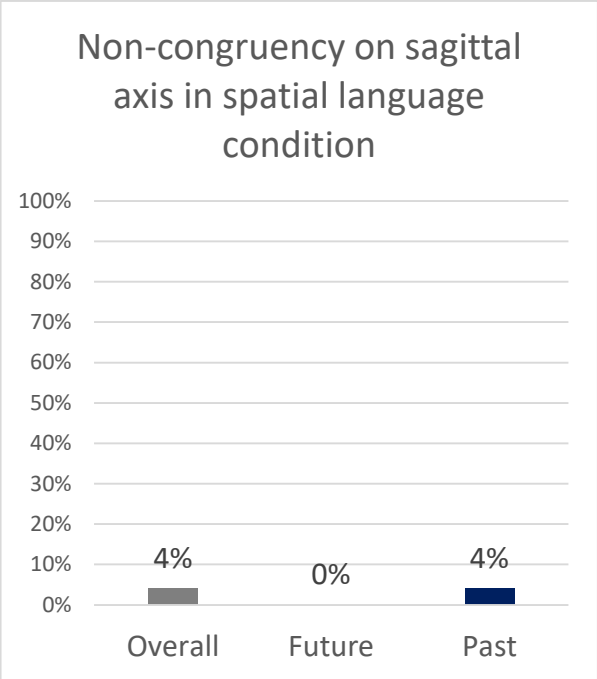

Figure 31: Non-congruent temporal gestures anchored on the sagittal axis in the spatial language condition. Grey bar: Overall sagitally anchored gestures produced in the spatial language condition. Red bar: Future orientated sagitally anchored gestures produced in the spatial language condition. Blue bar: Past orientated sagitally anchored gestures produced in the spatial language condition.

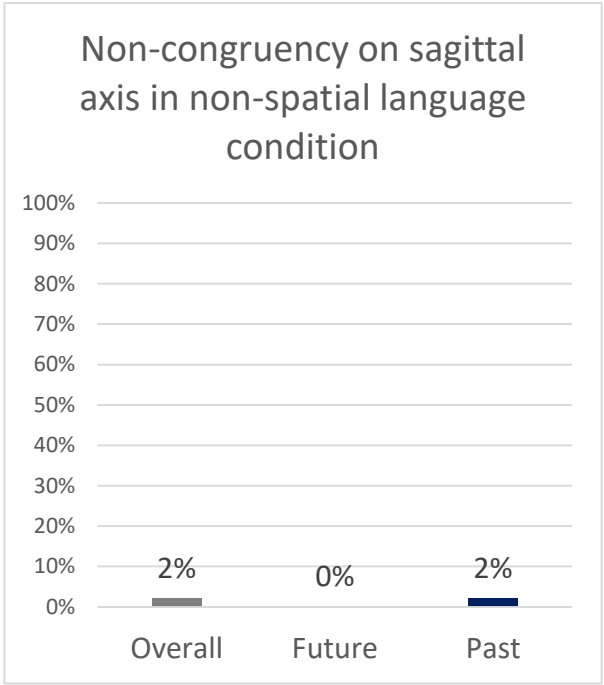

Figure 32: Non-congruent temporal gestures anchored on the sagittal axis in the non-spatial language condition. Grey bar: Overall sagitally anchored gestures produced in the non-spatial language condition. Red bar: Future orientated sagitally anchored gestures produced in the non-spatial language condition. Blue bar: Past orientated sagitally anchored gestures produced in the non-spatial language condition.

It can also be seen here that the above-mentioned 4% non-congruent gestures occurring in the condition in which spatial language was used to prime the participants (figure 31), and the 2% non-congruent gestures that occurred in the condition in which non-spatial language was used to prime the participants (figure 32), only occurred when the participants referred to the past. The future referenced non-congruent temporal gestures stay at 0%.

5.2.2.3. The use of the left hand, the right hand, and the head

We now turn to examine the data with regards to the ways in which the hands and the head were used to anchor the temporal gestures analysed above, focusing in particularly on the use of the left and right hand on the sagittal axis.

As stated above, a total of 123 gestures was produced, of which the majority with 37% was executed with the right hand, closely followed by the head with 34%, then the left hand with 20%, and lastly bimanual gestures with 9%. These gestures include all gestures produced in all conditions, for the future and the past (figure 33).

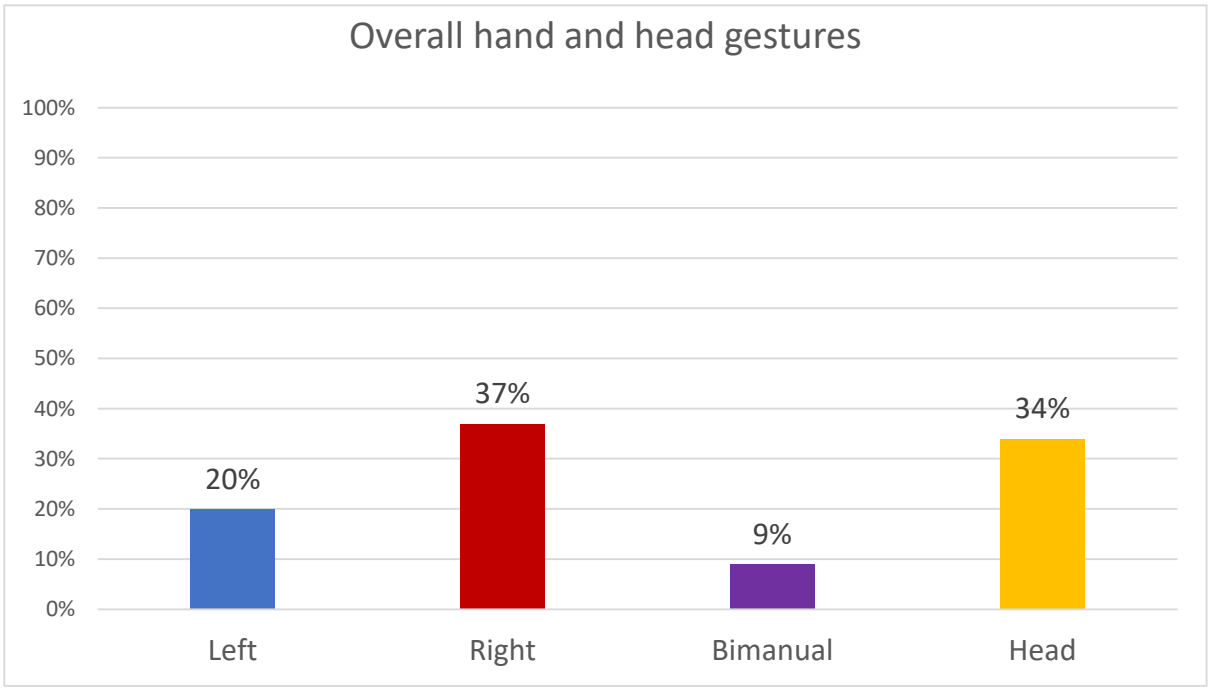

Figure 33: Overall handedness and head results for the future and the past reference combined. Blue bar: Proportion of left-handed gestures produced when speaking about the future and the past. Red bar: Proportion of right-handed gestures produced when speaking about the future and the past. Yellow bar: Proportion of bimanual gestures produced when speaking about the future and the past. Purple bar: Proportion of head gestures produced when speaking about the future and the past.

Dividing the different hand and head gestures according to future and past reference, it can be stated that the right hand was used 20% of the overall gestures, to anchor gestures, produced with future referenced phrases, onto space. The head was used 20% of the time in the past referenced stories. Furthermore, the left hand was used 11% for the past and 9% for the future, and the right hand was used 17% for the past and 20% for the future. Bimanual gestures overall occurred not as often as single handed or headed gestures (figure 34).

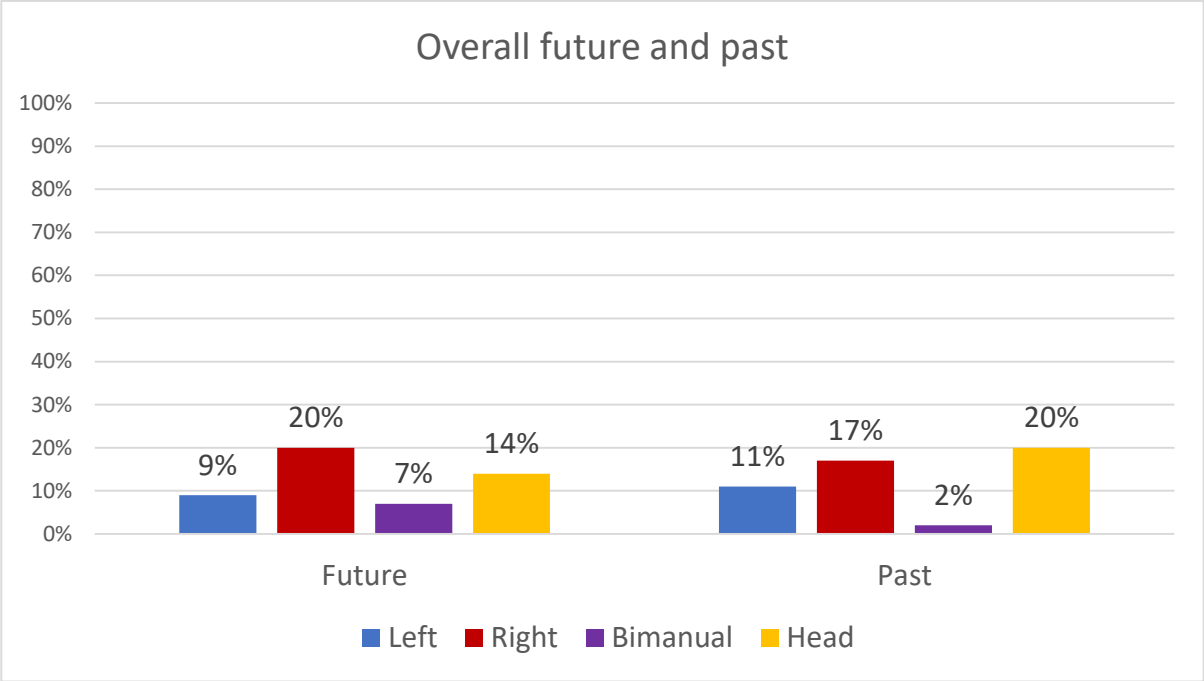

Figure 34: Overall handedness and head results for the future and the past reference, represented separately. Blue bars: Proportion of left-handed gestures produced when speaking about the future (left columns), and the past (right columns). Red bars: Proportion of right-handed gestures produced when speaking about the future (left columns), and the past (right columns). Purple bars: Proportion of bimanual gestures produced when speaking about the future (left columns), and the past (right columns). Yellow bars: Proportion of head gestures produced when speaking about the future (left columns), and the past (right columns).

More specifically, the gestures will be narrowed down to the ones anchored onto sagittal axis, with the focus on the gestures congruent with the spatio-temporal metaphors (figure 35). This will help to keep the focus on the second research question, which asks if there is an implicit laterality effect found in the left and right hand used to gesture on the sagittal axis. Specifically, the sagittal axis is referred to, because the lateral axis automatically triggers the use of the left hand when gesturing towards the left and the right hand when gesturing towards the right. On the sagittal axis, the participant can either use the left, the right, or both hands to gesture towards the front or the back. The gestures overall were a little lower, except for the bimanual gestures

that referred to the future. For the future, gestures produced with the left hand and right were 2% and 7% fewer, respectively. The bimanual gestures were not lower, and head gestures dropped by 7%. For the past, gestures produced with the left hand that were congruent with the spatio-temporal metaphors, were lower by 6%, the right-hand gestures dropped by 9%, bimanual gestures were lower by 2% and the head gestures were lower with 16%.

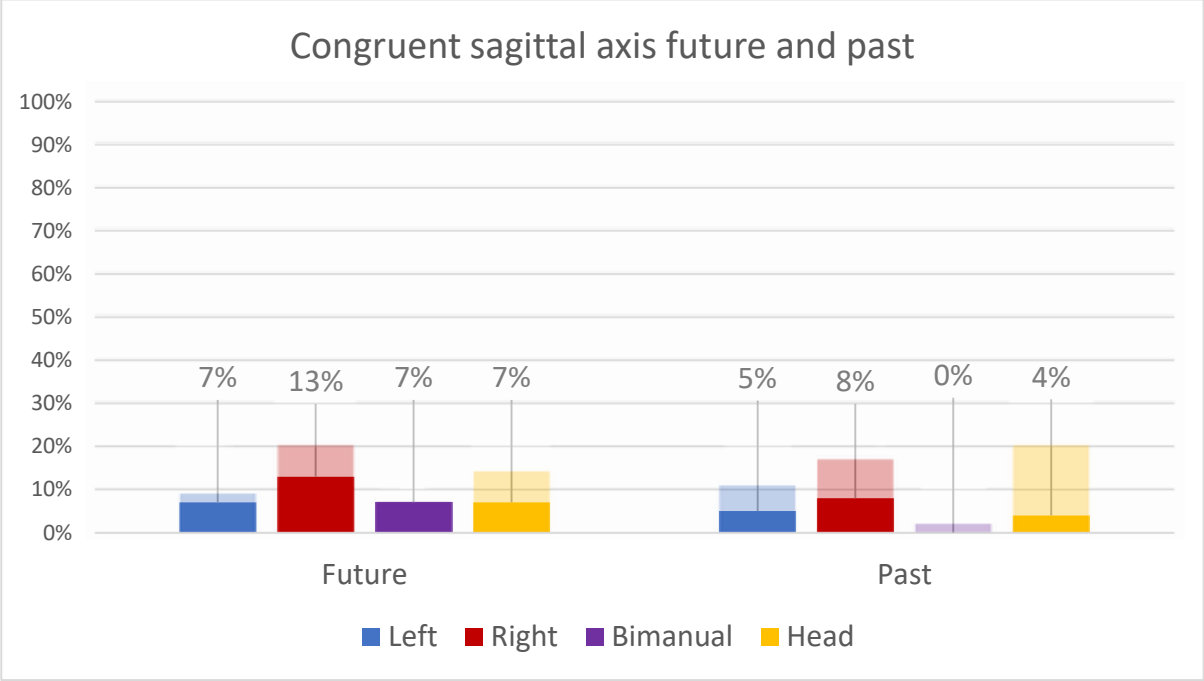

Figure 35: Congruent hands and head used on the sagittal axis for the future and the past. The faded bars seen rising above the solid color bars represent the overall gestures anchored on the sagittal axis in the spatial language condition. These can be found in figure 34. Blue bars: Percentage of left hand used to gesture for the future (left bars) and past (right bars). Red bars: Percentage of right hand used to gesture for the future (left bars) and past (right bars). Purple bars: Percentage of both hands used to gesture for the future (left bars) and past (right bars). Yellow bars: Percentage of head used to gesture for the future (left bars) and past (right bars).

Moving onto the different conditions that the participants were exposed to, the results are visualised below (figure 36 and 37). The result that stands out is the right hand ranking the highest when participants referred to the future in the sequence temporal reference condition (figure 36). The head was also used significantly more when reference towards the future was made, in the sequence temporal reference condition. For the past, the head carries the exact same percentage of 2% when participants referred to the past. The left hand is not significantly far behind in the percentages, but significantly stays in its range between 2-4% throughout all conditions for the future and the past (figure 36 and 37). Bimanual gestures on the other hand

were not used at all for the past reference but were used 2% for the future reference in both the deictic and sequence temporal reference.

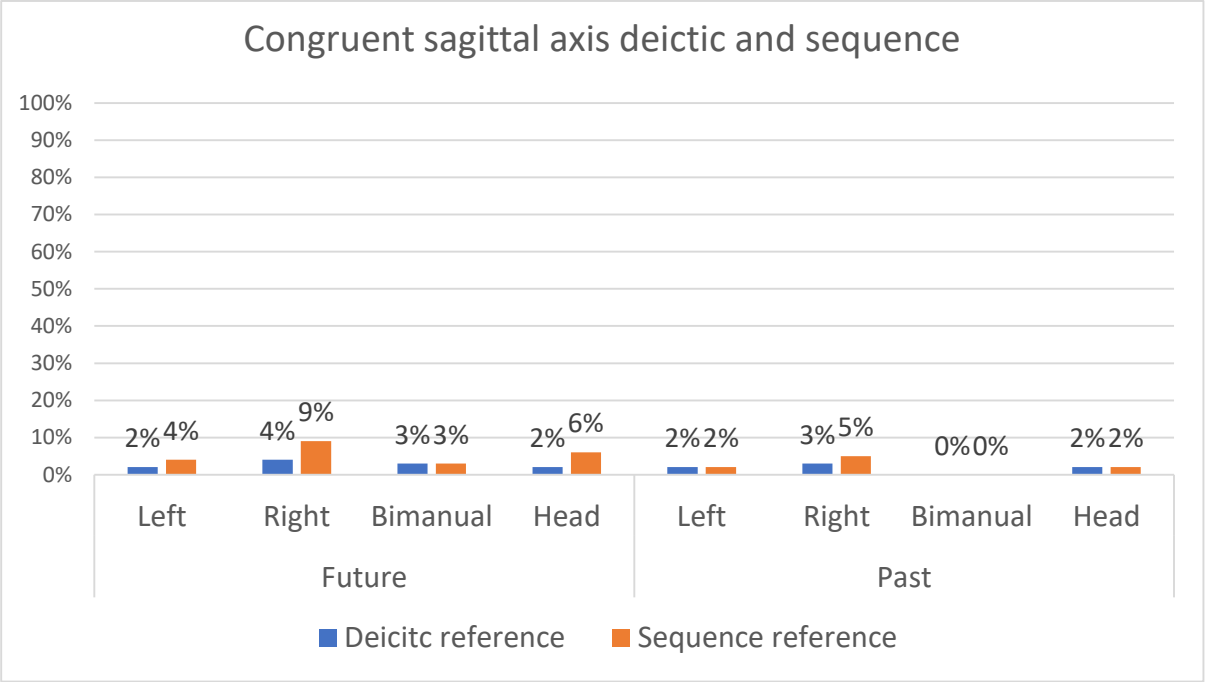

Figure 36: Hands and head used on the sagittal axis for the future and the past divided into the deictic and sequence reference. Blue bars: Percentage of the hands and head used to gesture in the deictic referenced condition for the future (left columns) and the past (right columns). Orange bars: Percentage of the hands and head used to gesture in the sequence referenced condition for the future (left columns) and past (right columns).

Again, the results for the spatial language condition and the non-spatial language condition do not vary considerably. The percentages for the bimanual gestures in both conditions for the future and the past are the same as in the previous condition, and the right hand again ranked the highest overall with 9% (figure 37). The head was used the second highest with 7% when gesturing towards the future in the condition in which spatial language was used, and only 1% in the non-spatial language condition (figure 37). Overall, there was no effect found regarding the left hand being used when gesturing about the past, and the right hand when gesturing for the future.

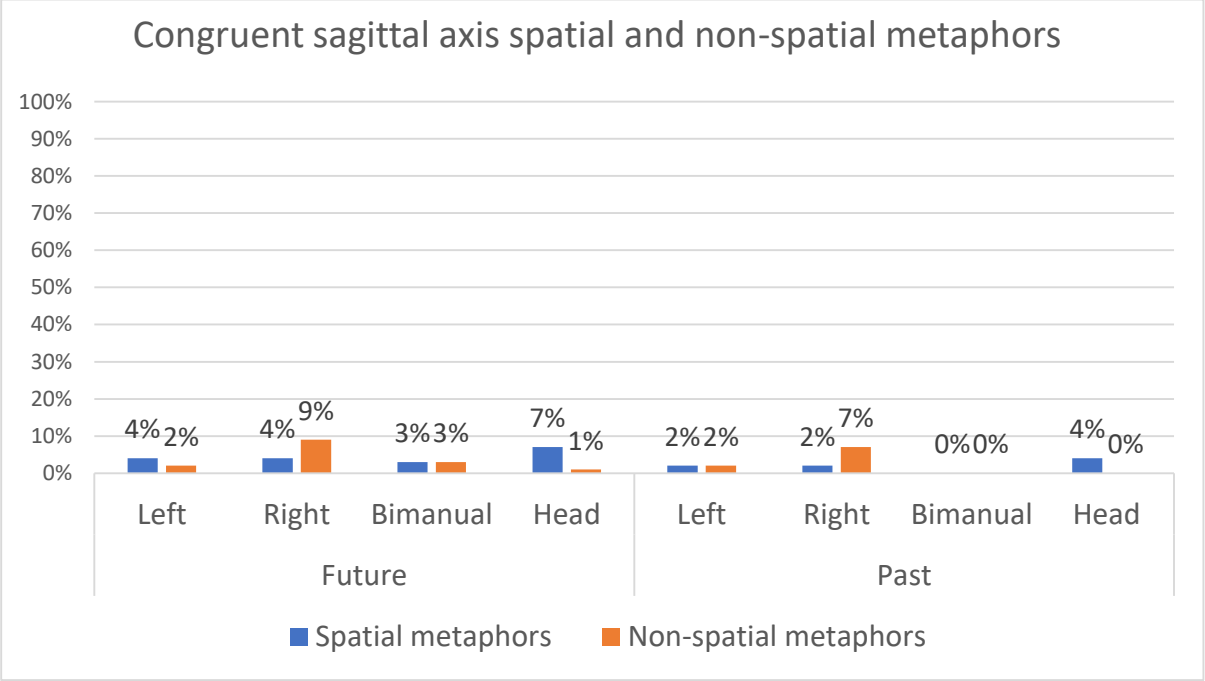

Figure 37: Hands and head used on the sagittal axis for the future and the past divided into the spatial metaphors and non-spatial metaphors. Blue bars: Percentage of the hands and head used to gesture when primed with spatial metaphoric language for the future (left columns) and the past (right columns). Orange bars: Percentage of the hands and head used to gesture when primed with non-spatial metaphoric language for the future (left columns) and past (right columns).

5.2.2.4. Eye and brow movement

Along with the hand and head gestures, eye and brow movement were also documented. Overall, 10 eye and brow movements have been recorded, of which 1 eye movement and 2 brow movements were identified in the future-referenced condition, and 4 eye movements and 3 brow movements were found in the past-referenced condition. Overall, 80% of the eye and brow gestures were co-produced with a head gesture. One was produced on its own and another was produced with a bimanual hand gesture.

Eye movements and brow movements were identified as significant temporal gestures if they differed from the usual blinking and occurred at the same time as the temporal gesture and/or the temporal speech produced during the experiment. Why a differentiation is made if they occurred either with or without the temporal speech will be clarified in the following section, where the alignment between the temporal gestures and the temporal language produced in speech will be looked at.

In the future referenced section, the overall 3 eye and brow movements occurred in the third group, which were the participants that received the stories that were used for the sequence referenced and spatial language condition. The one and only gesture co-produced with a bimanual hand gesture was this brow gesture, anchored on the sagittal axis moving away from the body. The brows at the same time were raised.

The eye and brow gesture, which also occurred in this future referenced condition, occurred together with a head gesture, which was anchored on the sagittal axis moving away from the body. The brows were also raised in this case, but additionally the eyes were also opened wider than usual, giving a sense that the participant was "staring" into the future.

For the past reference, 4 eye movements and 3 were brow movements were identified. The first 4 eye movement occurred in the story cluster, which had the deictic reference with spatial language. The first 3 eye movements were all co-produced with 3 head gestures, that were all anchored on the sagittal axis moving towards the back of the ego. The eyes in this case were closed shut for longer than a blink, while the head gestured towards the back (Miles, Nind & Macrae, 2010). The brow movement that also occurred in this group stood alone, and was a simple brow raise, which were accompanied by a head gesture moving towards the back.

Further 3 eye and brow movements occurred in stories using the sequence reference and spatial language. The first eye movement accompanied a head movement, which was sagitally anchored and moved towards the back. The eyes were closed shut, the same as in the gesture explained above. The 2 brow movements that occurred in this group, were both raised. Even if this might be taking it a step further, these 2 brow movements could have been interpreted as if they were to jump over the head and towards the back towards the past. They were both accompanied by head movements. However, the one head movement was anchored on the sagittal axis and moved the head towards the back, and the other head gesture was anchored laterally and moved towards the left.

Overall, it becomes clear that all eye and brow movements occurred in the spatial language condition, the eye movements carry a pattern of opening wide when the participant spoke about the future and closing shut when the participant spoke about the past. The brows on the other hand carry a non-differentiating pattern of being raised for both the future and the past, which

could be explained due to restricted mobility, meaning that the brows can only move up or down, of which the up movement might come easier to humans than the down movement.

5.2.2.5. Alignment between gestures overall and speech

As mentioned above, a difference was made between eye and brow movement either being included when they co-occurred with temporal gestures or temporal speech. A difference is made here, because it became clear throughout the study that participants' temporal gestures would sometimes precede the temporal speech, therefore not being aligned. They would be misaligned to up to maximum one second, which could be influenced by the nature of this study (i.e. participants having to commit verbal information to memory and then retrieve it for retelling).

Overall, from the 123 gestures that were produced, 7 gestures significantly preceded the temporal phrase that it accompanied. All of them formed part of the gestures that were congruent on the lateral and sagittal axis. Of these 7 gestures, 5 occurred in the past reference, and 2 in the future reference. The ones that occurred in the future reference, were both in the deictic temporal reference condition and both occurred before the word *toekoms* (future) was uttered., of which one was part of the spatial language condition and the other in the non-spatial language condition. Both these occurrences were on the sagittal axis.

With regards to the past reference, 2 gestures preceded speech in the deictic temporal reference and 3 in the sequence temporal reference. In the deictic temporal reference, both misalignments occurred on the sagittal axis, before the participants uttered the word *terug* (back). These also occurred one in the spatial language condition and the other in the non-spatial language condition. The last 3 gestures that preceded speech occurred in the sequence temporal reference. Two of them were in the spatial language condition, that occurred with the words *terug* (back) and *verlede* (past). The last gesture produced for the past reference stories occurred in the non-spatial language condition before the participant uttered *ou dae* (old days) and gestured on the lateral axis.

6. Discussion

6.1. Introduction

In the previous chapter, the results of both experiments investigating the production of deliberate gestures and spontaneous gestures in different conditions were reported. With the data given, and an overview produced, stating differences, similarities and patterns that became clear, these numbers and numerical representations will be analysed in the current chapter. Overall, it became clear, that in the deliberate gesture experiment, the majority of the gestures were anchored onto the sagittal axis. While having investigated the anchoring of the gestures on the sagittal axis further, an implicit laterality effect came visible regarding the left hand and the right hand when used to gesture for the future and the past. A unidirectional flow of time, as found universally around the world, occurs when participants anchor their gesture onto the sagittal axis, but use their left hand for the past and their right hand for the future (representing the lateral axis). For the spontaneous gesture experiment, the majority of the gestures were also anchored onto the sagittal axis, yet no implicit laterality effect was found. However, additional to the hand and head gestures, co-occurring eye and brow gestures were found, in which a pattern was found. When participants would talk about the future, then the eyes would open wider, and when they would talk about the past, then the eyes would stay closed for longer than a blink. The analysis will be guided by the foundational work done in the literature reviewed in chapter 2 and the theoretical frameworks detailed in chapter 3. The data from the deliberate gestures will be analysed first, followed by an analysis of the spontaneous gestures.

6.2. Deliberate gestures in Afrikaans

In this section, we investigated deliberate gestures by asking participants a pair of questions, which fell into one of the four conditions, set out in chapter 4. The raw results gotten from the data is presented in chapter 5 and will be analysed below. First, the focus will be on the axes used to anchor the temporal gestures, and then the focus will shift onto the different conditions used to prime the participants.

6.2.1. Axis reference

The axes that the participants referred to were either the lateral axis. The temporal mapping on the lateral axis, which will be further explained below, is influenced by the directional flow of

cultural artefacts in Afrikaans, which determine the past lying towards the left of the ego and the future towards the right of the ego. The sagittal axis is influenced by spatio-temporal metaphors found in Afrikaans, on which the future lies towards the front of the ego, and the past towards the back of the ego, which will be determined further through the following discussion.

6.2.1.1. Lateral axis

In the current experiment on deliberate gestures, 15% of the participants' gestures were anchored onto the lateral axis and were all congruent with the layout of the temporal mapping in Afrikaans, which is the past lying towards the left and the future towards the right, influenced by the cultural artefacts. In other words, the lateral mapping of time can be explained in terms of cultural relativity, according to which the anchoring of temporal gestures on the lateral axis is influenced by reading and writing direction and other artefacts found in language like Afrikaans, (which relies on left to right orthography) (Ouellet, Santiago, Israeli & Gabay, 2010:308; Casasanto and Jasmin, 2012:657; Bonato et al., 2012:2260; Casasanto and Bottini, 2014:477), and not the spatio-temporal metaphors that occur in these questions. Even though the percentage for these specific temporal gestures is low, they still follow a flow of time viewed as from the left to the right. The medium of input in this experiment could not have influenced the outcome of the lateral axis being used to anchor the temporal gestures, because the questions were presented in an auditory modality, therefore no immediate priming through left to right reading was present. This does not rule out, however, that repeated exposure to cultural artefacts such as orthography may have a more long-term influence on participants' mental time, as suggested by these left to right representations.

The study by Casasanto and Jasmin (2012), which used the same methodology as in this study, found a not so significant difference between the lateral and the sagittal axis for deliberate gestures. They found a close to 50/50 division between the anchoring of the temporal gestures on the lateral and sagittal axis, with 41% of the 99 gestures of interest being anchored on the lateral axis, and 59% of them being anchored on the sagittal axis (2012, 650-652). In our study, all the 128 gestures were congruent with the temporal mapping on both axes, and the division was more of a 15/85 division, of which 15% were anchored on the lateral axis and 85% were anchored on the sagittal axis, suggesting that in Afrikaans, spatio-temporal metaphors do have

a significant influence on the participants, anchoring their temporal gestures onto the sagittal axis. More on that, in the section below.

6.2.1.2. Sagittal axis

Of the 128 temporal gestures produced, 85% were anchored onto the sagittal axis, being in line with the proposed temporal mapping found in spatio-temporal metaphors. In other words, the temporal gestures produced in this study followed the spatio-temporal mapping found in the metaphors used in Afrikaans, in which the future lies ahead of the ego and the past behind the ego. This is seen in most of the gestures either signalling away from the ego or towards the back of the ego when referencing for the future or the past respectively, more than gestures that were used to signal towards the body when gesturing about the past. This coincides with the data found in Casasanto and Jasmin's (2012) study of deliberate gestures. Of their reported sagitally orientated gestures, most were also either away from the ego or towards the back of the ego, when referencing for the future and the past respectively, and only one gesture was towards the ego (2012, 650).

The relation between directionality and temporal reference regarding the future and the past, have been manifested in language, not only in Western cultures, but also more specifically Afrikaans. Spatio-temporal metaphors found in Afrikaans designate the front to the future and the back to the past, as seen in this metaphorical phrase *ons laat die verlede agter ons (leave the past behind us).* It relates to and is congruent with the conceptual metaphor theory (see chapter 3), more than in Casasanto and Jasmin's (2012) study. It therefore speaks to the importance of looking at different languages to better understand temporal mappings.

6.2.2. Temporal reference

The elicited questions posed to the participants that were laid out in such a way, in the study there were four pairs of questions, where the first two showed deictic temporal reference and the last two showed sequence temporal reference. In these two major groupings, one pair of questions in each group included directional metaphors, and the other pair included non-directional metaphors. The results of the data in this section are divided into the deictic temporal reference, the sequence temporal reference, and the influence of the directional temporal metaphors and the non-directional metaphors.

As explained in chapter 3, the difference between the deictic and the sequence temporal reference is how the ego is integrated into the flow of time. In the deictic temporal reference, the ego determines the now, and the ego moves through time. In the sequence temporal reference, the ego watches as time moves by. The results showed however that that the lateral axis was used to anchor the temporal gestures in the deictic and sequence temporal reference only by 8% and 7% of the participants, respectively. On the sagittal axis, 42% of the temporal gestures were produced in the deictic reference, while 43% of the gestures were produced in the sequence reference. The gestures produced on the sagittal axis had close to the same results in the deictic and the sequence temporal reference condition, and again showed that the temporal reference had virtually no influence on which axis the participant would anchor their deliberate temporal gesture.

6.2.2.1. Directional metaphors and non-directional metaphors

A further view point we can take on is by looking at not only differences and similarities between the two mentioned temporal references (the deictic and sequence reference) but by looking at what similarities and differences the two conditions (which include either directional or non-directional metaphors in the question pairs) have.

As it could be seen in the results in the previous chapter, the percentages for the lateral axis in both the directional and the non-directional metaphors conditions were very low, with 5% and 11% respectively, and the temporal gestures anchored on the sagittal axis in these conditions were very high, with 45% and 39% respectively. No statistical significance occurred, meaning that the different conditions did not prime the participant to gesture more on one axis than the other. However, a slight increase in lateral gestures can be seen in the condition of the non-directional language used. Double the gestures occurring in the spatial metaphors condition occurred in the non-spatial condition, and the anchoring of the gestures on the sagittal axis is 6% lower in the non-spatial metaphoric condition than in the spatial metaphoric language condition. In these results, it becomes a little bit clearer, that the directional metaphoric language primed the participants more than the non-directional metaphoric language to anchor their gestures on the sagittal axis, which would explain the slight increase of the reference on the lateral axis in the non-directional metaphoric language condition. In other words, the spatio-temporal metaphors that explicitly signalled the future lying ahead and the past lying behind

the ego, may have primed the participants to gesture towards the front for the future and gesture towards the back for the past.

Although Casasanto and Jasmin (2012) find similar results in their study regarding the anchoring of deliberate gestures on the lateral and the sagittal axis, when they investigated English speakers, and Casasanto (2016b) states that there is a dissociation between temporal language and temporal thinking. The present research suggests otherwise. Even though it is only the deliberate gesture part, and there is more to be said when coming to the spontaneous gestures, one can already see the impact that temporal language has on temporal thinking, made clear through temporal gestures. This impact of language on thought gives an insight in how spatial-temporal metaphors in Afrikaans guide the speaker's perception and internalisation of the merge between time and space, and how this is processed by the cognitive system. This can be linked to again the conceptual metaphor theory, that it could be seen as tentative evidence for linguistic relativity, keeping in mind that gesture is a co-verbal type. It concludes that speakers of different languages perceive and make sense of the world differently, hence language influencing thinking (Casasanto, 2016c; Lakoff and Johnson, 1980:5).

Yet, this is where the interpretation by Casasanto and Jasmin (2012) stops and does not report any further results regarding handedness. They focus on the axis, but do not report on whether the hands (i.e., left and right) interacted with the anchoring of the gestures on the axes, which is why the aspect of the handedness was recorded and analysed in the present study.

6.2.3. Handedness and the implicit timeline

As mentioned in the results, all participants in the research of deliberate gestures had their right hand as their dominant hand. Looking at the data in more detail, the left hand, the right hand and bimanual use of the hands all differed when focusing on the gestures produced for the future and the past. Overall, the right hand was used 63% to produce temporal gestures, when participants referenced for the future and the past. This is likely to all participants having their right hand as their dominant hand, and therefore this hand being the default also when it comes to producing these gestures, possible because of fluency in production.

Even though the right hand was the preferred hand to produce the temporal gestures, the left hand still shows a significance in its choice to be used when participants referred to the future

and the past. It becomes interesting when pulling out the data for the future and the past, that occurred only on the sagittal axis (the axis on which the future lies towards the front and the past towards the back, in English and Afrikaans). A pattern becomes visible. When participants gestured for either the future or the past, then the right hand was used more often to reference the future and the left hand was used more often to reference the past. To bring in the data to clearly portray this pattern, the left hand was used 19% to reference towards the past, and the right hand was used 41% to reference towards the future.

The effect, found in the left hand used to gesture towards the past and the right hand used to gesture towards the future, could be referred to as a laterality effect. In both cases, statistically significant results mean that a correlation can be found for the left hand being predominantly used to gesture with for the past, and the right hand being predominantly used to gesture with for the future. What this intriguing pattern then seems to suggest is that the lateral axis is still active even when the temporal gestures are produced on the sagittal axis. It should be noted that the participants were not aware of their hands being recorded, likely to the laterality effect found in the hands used to gesture about time being implicit. This could therefore lend to be further evidence for the spatial-temporal association of response codes effect (STEARC).

The STEARC effect is brought about in the way cognitive representations of stimuli, such as numbers, pitch and the alphabet, carry certain characteristics that influence the speed of response time tests (See chapter 2 for overview). The coding of spatial and temporal information along the mental timeline may facilitate manual responses, which is in this case the use of the left hand when indicating about the past and the right hand when indicating about the future (Ishihara, Keller, Rossetti & Prinz, 2008:455). The STEARC effect represents the idea, that a quicker response time is elicited when a left-sided response is elicited with the past, and a right-sided response is elicited with the future. Due to participants implicitly choosing the left hand for the past and the right hand for the future, it can be hypothesised, that if the response time in the laterality effect would be tested in this study, then the response with the left hand for the past and the right hand would be faster than, reversing the hands for the future and the past.

We can now look further at the differences in the conditions and how handedness played a role, with the focus still being on the sagittal axis. As stated above, the left hand was predominantly

used to gesture for the past and the right hand used to gesture for the future. Looking in detail, if the different conditions had an impact on the handedness on the sagittal axis, something that stands out, is that for the past reference, the left outnumbered the right hand in the sequence temporal reference condition, while the right hand outnumbered the left hand in the deictic temporal reference condition. For the future reference, the left hand was used close to 0% for both conditions, where the right hand outranked the left hand for both conditions with 20%. Going back to the occurrence in the past reference, the explanation for these results could be that the right hand was preferred in the deictic temporal reference condition due to this condition placing the ego on the mental timeline, on which the past lies towards the back of the ego (the participant, in this case). Therefore, language could have a stronger effect in the deictic temporal reference condition and the dominant hand plays the dominant role. In the sequence temporal reference, the ego is placed outside of the mental timeline, looking onto chained events, therefore the implicit timeline of the laterality effect explained above has a chance to come to the forefront and the left hand is predominantly used. The occurrence of the implicit laterality effect can provide further nuance evidence for the STEARC effect, in which it explains evidence for the existence of a mental timeline.

The last condition to be looked at in this section is the use of directional metaphoric language. The first thing that stands out is that for the past reference, the use of the left hand in both conditions are the same percentage, the use of the right hand for both conditions are the same and the bimanual gestures are the same in both conditions. There is therefore no influence of non-spatial and spatial metaphoric language use in the past reference regarding the handedness. The right hand carries a higher percentage overall than the left hand and bimanual gestures in both the future and the past in both conditions, which can be again explained through the right hand being the dominant hand. The left hand does however pick up in the past reference, which is explained above through the occurrence of the laterality effect coming to the forefront.

The bimanual hand gestures, which overall occur in the deictic and sequence temporal reference condition and in the directional and non-directional language condition, never go above 10%. They do, however, by a very small percentage, occur more in the future reference than in the past reference, and in the future reference, they occur more in the sequence temporal reference and in the non-directional metaphoric language condition. The higher occurrence in the future, could be due to a kinematic factor (Casasanto, 2016b:179-180), because it is easier and more

"do-able" to gesture with both hands towards the front, than towards the back, risking a self-injury in the latter. In other words, it requires more effort to gesture with both hands towards the back. Our bodies are "designed" by nature, to execute activities that occur in front of our bodies, where our eyes and tools (i.e. arms) are. Therefore, muscle and joint movement in the arms are more flexible and stronger when they are applied for activities towards the front. It also explains why we cannot move our arms more than about roughly 10 degrees past our heads and roughly 70 degrees past our hips. Bimanual gestures that gesture towards the past, usually go over the head, as if the person would be scooping the past over the head towards the back. This is where the 10-degree movement past the head comes in, which restricts the bimanual arm movement towards the back, explaining the low percentages in the past reference.

The higher occurrence of the bimanual gestures in both the sequence temporal reference condition and the non-directional metaphoric language conditions, could be explained by the fact that both these conditions lack explicit linguistic temporality that either puts the participant into the deictic "now", or telling the ego towards which direction the future and the past lies. The lack of this explicit temporal language could be further evidence for the thinking for speaking hypothesis, set out in chapter 3. In this hypothesis, it is stated that language influences thought while someone is in the process of preparing content for speech, and speakers of different languages specify and focus on different aspects in speech and therefore make sense of reality differently. Therefore, it could be said, even though the percentage in this regard is small, the lack of directional language, which puts the ego into the flow of time, the lack of spatial language telling the ego towards what direction the future lies, the participant tended to gestured bimanually. Therefore, the participant did not give reference to either only the left or only the right hand. In other words, to generalise, the temporal directionality was not specified, therefore the handedness was also not specified to either the left or the right hand.

6.3. Spontaneous gestures in Afrikaans

The stories used for the spontaneous gesture experiment can be found in Appendix H. This section will comprise a discussion of the gestures produced, co-occurring with the temporal speech that the participants produced.

6.3.1. Axis reference

In this experiment, such as in the deliberate gestures experiment laid out in the beginning of the chapter, all temporal gestures were produced on either the lateral or the sagittal axis. Even though all gestures were produced on the axes of interest, not all gestures were mapped the past towards the back on the sagittal axis, or towards the left on the lateral axis, which would be the predicted default according to Afrikaans metaphors and orthography.

In Casasanto and Jasmin's (2012) study, a clear preference for the lateral axis amongst English speakers in spontaneous co-speech gestures was found, which was explained as being cultivated through reading and writing direction of the speakers' language, as well as other cultural artefacts such as the directional flow found on graphs. Cooperrider and Núñez (2009) also observed primarily lateral co-speech gestures for time.

In the present study, however, a prevalence in either of the axes was not found. Of the 123 gestures produced, 45% were anchored on the lateral axis, and 55% on the sagittal axis. The reference on the sagittal axis outranks the reference on the lateral axis. Even though, one would have thought that the lateral axis would naturally be made use of more than the sagittal axis (as was the case with Casasanto & Jasmin's findings), due to cultural conventions having had a major influence in most Western cultures' time line (Fuhrman & Boroditsky, 2010; Rolke et al, 2013), this does not seem to be the case amongst Afrikaans speakers. The gestures that were produced on the lateral axis, however, are presumably influenced by reading and writing direction and other cultural artefacts such as the temporal flow on graphs. The sagittally orientated temporal gestures produced, in turn, are in all likelihood influenced by the spatio-temporal metaphors used in Afrikaans, which place the future ahead of the ego and the past towards the back of the participant.

When looking at the division of the future and past reference on either the lateral or the sagittal axis, overall, the future was referenced more on the sagittal axis, and the past was referenced more on the lateral axis. The sagittal temporal gestures referencing the future, are influenced by the spatio-temporal metaphors found in Afrikaans, as explained above. However, why the temporal gestures for the past were predominantly anchored on the lateral axis, could be explained through the kinematics of lateral gestures, defined by Casasanto (2016b; Casasanto & Jasmin, 2012). Gestures produced on the lateral axis have a reach that is about twice as long

as the reach on the sagittal axis, on which the poles of the future and the past are more motorically reachable than on the sagittal axis (Casasanto, 2016b:179-180). Therefore, when gesturing about the future, the sagittal axis is the first implicit choice of the participants, due to the spatio-temporal metaphors having a higher-ranking influence on the choice, then the directional flow of cultural artefacts, such as graphs and calendars. When participants gestured about the past, then the human motoric came into play, and the kinematic explanation given above has a higher ranking than one based on spatio-temporal metaphors, and therefore participants placed their pastward temporal gestures onto the lateral axis, which is in line with the reading and writing direction in Afrikaans.

Specifically, in the sequence temporal reference condition (where the ego takes on the flow of time), the lateral axis was used predominantly to anchor the temporal gestures. In this condition, the ego, or in this case the participant, was not the reference point of the "now" in time, but rather looked at time from an outside viewpoint, watching how it passed by. In the sequence temporal reference condition, the participants therefore gestured on the lateral axis because the mind's eye viewed the occurrence of events flowing on the horizontal axis in front of them, with the ego/participant looking onto the events from an outside stance. And this was true for the temporal gestures produced on the lateral axis in the sequence temporal reference condition, when they had to gesture for the future and the past.

The data for the spatial and non-spatial metaphoric language conditions painted a slightly different picture. Gestures produced in this collapsed grouping first showed no difference, in the overall lateral anchoring of the temporal gestures. However, the picture becomes clearer when looking at the division between the future and past reference. Majority of the temporal gestures produced in the spatial and non-spatial metaphoric language condition occurred in the past reference grouping. This can be following evidence for the same occurrence that happened earlier, in which participants implicitly preferred to anchor their pastward gestures onto the lateral axis, due to motoric restrictions hindering a sagittally orientated movement towards the back.

Moving onto the overall gestures anchored onto the sagittal axis in the deictic and sequence, as well as the spatial and non-spatial language conditions, no big difference was found in either the futureward or pastward reference. The division of temporal gestures throughout the

conditions were rather equal, which shows that the specificity of the different conditions had no impact on choosing the sagittal axis to anchor these gestures. The sagittally anchored temporal gestures were, as stated above, influenced by the overall occurrence of spatio-temporal metaphors in Afrikaans in general, mapping time onto the front-to-back axis.

6.3.1.1. Congruency and incongruency between gestures and spatio-temporal metaphors and reading-writing direction

Above, we have looked at the overall temporal gestures produced on the lateral and sagittal axis and explained why these axes were chosen to anchor the gestures on. Below, we will focus on the extent to which the temporal gestures produced were congruent or incongruent with the spatio-temporal metaphors and reading-writing direction. What is meant by congruency of gestures with spatio-temporal metaphors and reading-writing direction, is that in language, the spatio-temporal metaphors place the future towards the front and the past towards the back. Therefore, the temporal gestures that would be congruent with the spatio-temporal metaphors, would place the future towards the front and the past towards the back. When temporal gestures would be congruent with the reading and writing direction, then the temporal gestures would place the past t onwards the left and the future towards the right, because in the flow of reading and writing, we start from the left and move towards the right, leaving the past behind towards the left, and moving into the future towards the right. Overall, 81% of the gestures produced were congruent with the cultural conventions. The congruency between the gestures anchored on the lateral axis and the mapping of time in cultural conventions, and the gestures anchored on the sagittal axis and the mapping of time in the spatio-temporal metaphors found in Afrikaans, and why incongruencies occurred, will be discussed below.

6.3.1.1.1. Lateral reference

The gestures produced on the lateral axis were overall 12% lower than the overall 37% gestures produced in the sequence temporal reference, and 4% in the non-spatial metaphoric language. The decrease is overall close to equal in the futureward and the pastward gestures. For the futureward stories in the sequence temporal reference condition and the non-spatial metaphoric language condition, the trigger for the incongruent gestures all involved the stories' phrase *my kinders […] en hulle kinders*, "my children […] and their children" translated into English. The incongruent gestures produced were anchored towards the left on the lateral axis, which is

conventionally used for the past reference, but in this case used to refer to the participant's imaginary children. A clear correlation between the incongruency and the temporal phrase cannot be seen. The first possible explanation for the incongruency between temporal gestures and the spatio-temporal metaphors and reading and writing direction, could possibly be due to the participant talking taking on the perspective of the interlocutor. It is a hypothesis that can be investigated further, because an incongruency between temporal gestures and spatio-temporal metaphors is also found (see section 6.3.1.1.2 Sagittal reference).

A further possible explanation could be that of the bodily relativity hypothesis, which states that bodies are different and askew, which can have an influence on an individual's perception of the world around them. This becomes most visible in the handedness of people and what their dominant hand is. Right-handed people prefer doing things with their right hand, or they prefer things that are on the right-hand side of space (Casasanto, 2014:109-111), as seen in experiments set out in chapter 3. The majority of the participants that took part in this study were in their 20s and studying, or just started their first job. From personal experience, when one is in that life phase, individuals do not necessarily think about having children, because the primary goal is to establish one self. Therefore, having to pretend in the conditions, that one was going to have children, this could have triggered a negative emotional valence, which was represented towards the left-hand side on the lateral axis, with this side being the non-dominant side and therefore the side associated with negative valence (Casasanto and Chrysikou, 2011:420-422).

The pastward gestures, which were incongruent in the sequence temporal reference and the spatial metaphoric language condition, had a clear linguistic trigger, such as *voor* (ahead) in the phrase *my oupa voor dit* (my grandpa before that). In that part of the story, participants had to explain how their dad, their granddad and their granddad before that smelt like. Instead of laying out the three generations towards the left or towards the back, 7% of the participants in the sequence generation, and 8% in the spatial metaphoric language condition, gestured either away from the body, towards the front or towards the right. The gestures away from the body can be explained that the literal meaning of the word *voor* was represented with the away gesture towards the front, therefore not even considering the relationship between the different generations, which was further into the past. The lateral gesture towards the right can be explained, that the three generations were a listing, things that were itemized. And since the

cultural conventions in Afrikaans flow from the left to the right, such as the flow of graphs and reading and writing direction, the three items listed, which were the dad, the granddad and the granddad before that, so were the items listed, from the left towards the right.

The one condition that has not been looked at yet in this section, is the deictic temporal reference section. The overall finding in this condition is that for the future reference, all gestures were congruent on the lateral axis. However, an incongruency of 2% was found in the past. The incongruent gestures that were produced were not triggered by any of the temporal conditions, but rather by the setup of the experiment. This occurred with the first pair of participants that volunteered to take part in the study, which were participant number 1 and participant number 17. In the room, there was a table against the wall. The participants were seated in such a way that they sat across from each other next to the table. The participant 17 was therefore able to lean their left hand onto the table and the participant 1 was able to do the same with their right hand. The motoric explanation of the gestures produced for the past by participant 1, are that they leaned on the table with their right hand, while also gesturing with it, and therefore gestured with that hand towards the right for the past, which could have also been a gesture meant to go towards the back of the body. It is being assumed that that gesture was meant to go towards the back of the body, but because of comfort and leaning on the table the gesture went towards the right. If the gesture was meant to go towards the left, then the left hand would have been made use of, due to easier reach towards the left-hand side.

6.3.1.1.2. Sagittal reference

The temporal gestures that were produced on the sagittal axis, regarding the futureward time frame, were all congruent in all conditions. This can signal towards other influences having little impact on possible deviations. In other words, the temporal reference on the sagittal axis for the future is so deeply ingrained through the spatio-temporal language used in Afrikaans, that other factors are not strong enough to play a role in manipulating the anchoring of the gestures. The sagittally anchored gestures for the past, however, were slightly lower overall in all conditions. This could be due to the deviation from the congruent gestures that co-occurred with the same phrases that also triggered an incongruency in the section above on the lateral axis, namely at the word *voor* (ahead), which was found in the phrase *my oupa voor dit* (my grandpa before that).

6.3.1.2. Hand and head gestures' congruency with the sagittal axis

Looking at the hands and head used to produce the temporal gestures and anchor them onto the lateral and sagittal axis for the future and the past, in all the conditions, no significant pattern was found. In more detail, no clear laterality affects between the future and the past, and the left hand and the right hand was found, as in the deliberate gestures study. The right hand was predominantly used in the future and the past reference. The bimanual gestures interestingly occurred only in the future reference, and none occurred in the past reference. This, similarly to the deliberate gesture investigation, can be explained through the motoric restriction that would occur, when one would use a bimanual gesture to gesture towards the back. The head, overall, was used more to gesture towards the future than the past, due to perhaps the forward movement being easier executed than the backward movement. Head movements, however, seldomly occurred alone, which leads straight into the next section of eye and brow movements found in the data.

6.3.1.3. Eye and brow movements

In Cooperrider and Núñez's (2009) study, the body parts that produced gestures and were looked at were the head, finger and foot points, which occurred while participants talked about the evolutionary timeline image experiment (2009:191). In this study, data was additionally captured on eye and brow movements that occurred during the experiment of spontaneous gestures. As explained in chapter 5, eye and brow movements were captured if they differed from the usual blinking and occurred at the same time as the temporal gesture and/or temporal speech produced.

Overall, eye and brow movements did not occur on their own, but usually accompanied a head gesture. One could call these emphasizing co-speech gestures. This is due to the head being motorically restricted, to only being able to move on one spot, and the eyes and the brows also being motorically restricted for the same reason. Therefore, the head, accompanied by the eyes and the brow, give emphasis on what the head gesture is trying to portray. The sum of them all paint a fuller picture than its parts standing alone. The brow is more of an emphasizing bystander than the eyes, due to what was seen in the data. For the future and the past, the brow movement that we got was raised brows, not finding a difference for the future or the past.

Therefore, they are emphasizing what is gestured with the head, trying to portray this image to the listener as clearly as possible.

The eyes, however, tell a different story for the future and the past. When they co-occurred with the head gestures referencing for the future, the all participants opened their eyes wider than usual and stayed open for longer than a blink. This can be likened to trying to see into the future, as the conventional phrase puts it. It also clarifies further, due to humans doing this naturally, that the future is placed in placed in front of us, because of our anatomy, of which we use our eyes to see what is ahead and up and coming. The opposite, for the past reference, was found amongst the eye gestures produced. When the head gestured towards the back, then the eyes were closed shut, for longer than a blink. This is similar to when trying to remember something, like trying to find a word. This, also occurring naturally, leaves the past behind us, and when trying to go back into the past, or trying to remember something, we mentally go backwards in time, by closing our eyes. This can be linked to Miles, Nind, and Macrae's (2010) conceptualisation of postural sway when people mentally move through time. This moving through time is made up of a relationship between thinking and acting. For example, when a person goes through retrospection, then the body of that thinker would move backward. If the person goes through prospection, then the body of that thinker would move forward. Miles et al. (2010) investigated the magnitude of these spontaneous fluctuations in postural sway by engaging the participant in mental time travel, in which they went through retrospection or prospection (2010:222). This is how the eye gestures could be further explained. When participant go through retrospection, then they close their eyes and mentally travel through time, into the past. When participants go through prospection, then they close their eyes and mentally travel into the future.

6.3.1.4. Alignment between gestures and speech

Lastly, throughout the study, a misalignment was found between the temporal speech and the temporal gestures produced amongst some participants. Conventionally, the speech and co-speech gestures are well aligned, most of the time occurring at the exact same moment, or they end before the utterance they are expressed with (McNeill, 1992:131). In this experiment, a certain degree of misalignment was found between the speech and the co-speech gesture, in that the temporal gesture produced would precede the temporal phrase in speech. Overall, a

misalignment between temporal gestures and temporal speech only occurred in congruent gestures. This can be explained that the gesture primes the speech that follows, which can be further explained with McNeill's (1992) growth point theory. The growth point would then be found in the temporal gesture that precedes the temporal speech, helping the speech to either be remembered, or to come forth with the phrase that the speaker is looking for. This shows a necessary interaction between gesture and speech. A preceding of the gesture before speech usually occurs when a person tries to remember something. The gesture therefore helps the process of remembering, normally a word or a phrase (Lucero, Zaharchuk and Casasanto, 2014:900). This could well likely be the case in this experiment. Participants were given pre-written stories, which were made-up, therefore completely unknown to the participants. They then had a minute to familiarise themselves with the story and then retell it to the friend. In the process of retelling it to the friend, some participants were having some trouble remembering part of the story, therefore using gestures as a helping mechanism. Some of these helping gestures were temporal gestures that were used to reference the future or the past.

6.4. Conclusion

In this last section of the thesis, the main points of the thesis will be stated, while also distinctly answering the research questions posed in the introduction. Further, it will look at the contribution of this study, and what it offers to the broader field of psycholinguistics and temporal cognition. It will then move onto the possible limitation of this study, how these could be rectified and lead to further possible research in the future.

6.4.1. Main points and contribution

No multimodal measurement of temporal cognition has been conducted on Afrikaans. This study aimed to not only assess how Afrikaans first language speakers think and gesture about time as elicited through deliberate questioning and story retelling, but to also fill a gap in research already done. The study placed its focus on the flow of the mental timeline amongst Afrikaans speakers, how this is elicited regarding the mapping of time onto space, and how this is elicited through temporal gestures.

It was hypothesised, due to previous studies and mainly Casasanto and Jasmin's (2012) study, that deliberate gestures would be anchored onto the sagittal and lateral axis, with the sagittal

axis probably having a higher prevalence, influenced by spatio-temporal metaphors found in Afrikaans. Spontaneous gestures were thought to be anchored onto the lateral axis, mediated by cultural artefacts such as the directional flow of orthography. These outcomes were assumed because these were the findings in Casasanto and Jasmin's (2012) research. Therefore, it was thought to be something found broadly across different kinds of languages.

6.4.2. Returning to the research questions posed

In this section, the research questions posed at the beginning of this thesis in chapter 1 will be presented again in the following paragraphs, and answered based on the data and analysis given in chapter 5 and 6.

The first research question and its sub question is as follows:

1. What axis do L1 Afrikaans speakers predominantly use when deliberately and spontaneously gesturing about time to indicate where the future and the past lies?

Findings in this thesis show that Afrikaans first language speakers predominantly anchor their deliberate and spontaneous gestures onto the sagittal axis, which goes against Casasanto and Jasmin's (2012:650-655) findings. It was hypothesised in this thesis that the anchoring of deliberate gestures was mediated by spatio-temporal metaphors found in Afrikaans, which place the future towards the front, and the past towards the back. Spontaneous gestures, in this case, were also anchored onto the sagittal axis, which could have various influencing factors. The spontaneous gesture results could contradict Casasanto and Jasmin's (2012) suggestion, that language does not influence temporal cognition and the mapping of time onto space in the mental timeline. In this thesis, however, language does seem to have quite a dominant impact on how time is mapped onto space. Further explanations for the mapping of spontaneous gestures could be that participants were in an environment which obligated them to read and write dominantly in English yet speak predominantly Afrikaans. Therefore, the reading and writing direction in the Afrikaans mind set would not have such an impact, as the spatio-temporal metaphors used in Afrikaans speech, leading to spoken language having the higher mediating power in how Afrikaans speakers anchor their gestures.

Including to the use of hands when gesturing about time, a pattern in the eye and brow movement was also found and reported on. Eye movement specifically, showed a difference in use when applied for the future or the past. Participants involuntarily opened their eyes wider when speaking about the future in the spontaneous experiment. It could be explained that they tried to look ahead into the future, signalling to something that is about to happen. These eye gestures could be coded to have happened on the sagittal axis, on which the future was ahead of the participant. For the past reference, participants closed their eyes shut, for longer than just a blink, as if they were trying to remember something, or perhaps look into the past towards the back. This again, could be coded as have happened on the sagittal axis, on which the past lies towards the back, behind the participant. Brow movements, however, showed no difference between the future and past reference, and could be referred to as emphasizing gestures, adding value to the eye movements presented for the future and the past.

The second research question and its sub-question, concerning the handedness part of this thesis is as follows:

2. Concerning sagittal gestures, do L1 Afrikaans speakers spontaneously refer to an implicit temporal axis, which is reflected in the usage of hands when referring to time?

Handedness was another medium looked at used to gesture about time. As hypothesized, it was found that concerning only sagittal gestures in the deliberate gesture investigation, Afrikaans first language speakers spontaneously refer to an implicit temporal axis, which is reflected in the use of hands. In other words, the lateral axis is reflected in the left hand being used to gesture about the past, and the right hand used to gesture about the future. This, furthermore explained as possible evidence for the STEARC effect, as seen in chapter 6. All this evidence gives insight in how the mind works, how cognition, in this case temporal cognition, is constructed, mediated, and altered. It shows how time is mapped onto space when looking at specifically the mental timeline. Broadening the perspective, the idea of mapping can be taken over to general concepts, may they be abstract and concrete, and how this form to understand cognitive systems, which are used to understand reality.

With the results presented and questions regarding deliberate and spontaneous explained, it can further be asked, if there are any differences or similarities between the deliberate and spontaneous gestures investigated. This will be done in the last research question below.

3. How far do deliberate and spontaneous gestures differ amongst L1 Afrikaans speakers?

When looking at the deliberate and spontaneous gestures produced, a difference would have been expected regarding the axes used, on which participants anchored their gestures, as seen in Casasanto and Jasmin's (2012) study. In their study, the deliberate gestures produced where anchored on both the lateral and sagittal axis, with no big difference between their percentages. For the spontaneous gestures, the temporal gestures produced, were predominantly anchored onto the lateral axis, reflecting the influence of the reading and writing direction. In this thesis, the deliberate and spontaneous gesture were both predominantly anchored onto the sagittal axis, with higher prevalence in the deliberate gestures than in the spontaneous gestures. This, as explained for the first research question, could be influenced by the spatio-temporal metaphors used in Afrikaans overall, due to participants predominantly speaking Afrikaans and reading and writing in English. Due to the experiment investigating Afrikaans first language speakers, the spatio-temporal metaphors used in that language take prevalence in mediating time onto space.

6.4.3. Limitations of current study and recommendations for further research

Possible limitations for this research could be the use of material for the second experiment, which looked at spontaneous gestures amongst Afrikaans speakers. The stories were made up and had to be read and retold by the participants. Even though, they were quite short, and the participants had more than enough time to read through the stories more than once, the situation quite often brought up the feeling of a testing situation and the anxiety that comes with it, likened to that of giving a presentation. Ways to alleviate this, could be to either change the medium used to test spontaneous gestures, so to rather use a picture that elicits temporality (like in Cooperrider and Núñez, 2000 study). The image used in Cooperrider and Nunez's (2000) study, however brings another problem, which is the flow of evolution that flows from the left towards the right, priming the participant. Another solution could have been, if the experimenter was to be removed from the testing situation, and the participants are left alone to their own means. Therefore, the feeling of anxiety could have been alleviated, and participants would not have to worry too much about remembering the stories.

In the second experiment, the problem of the table occurred. In more detail, participants were seated next to a table, on which they ended up placing their hands and therefore influencing the

way they gestured. For future reference, participants should be ideally seated across from each other, in an open space, or a room that has no obstructions on which hands or feet can be placed.

Another limitation, or rather something that can be broadened in further studies, is the occurrence of the participants predominantly speaking Afrikaans and reading and writing in English. This was not formally reported on, but was made clear in conversation. Although this gives another perspective on what influences the construction of the mapping of time onto space in the mental timeline, it cannot be generalised for all Afrikaans speakers. Further studies would have to be made, where these variables are considered. It could lead to investigating English and Afrikaans bilinguals being tested in the same scenario of storytelling, recording their results and seeing if they also indeed anchor their temporal gestures onto the sagittal axis, when they map time onto space.

Moving onto the handedness section discussed in this thesis, a laterality effect was found in the use of hands used to gesture for the future and the past. It is said, as stated in chapter three under the bodily relativity hypothesis, that different bodies perceive the world differently, and this relativity can be manipulated with different means. A possible further study would be the effect of mirror reading, and if the laterality effect is altered in any way, when looking at the hands. For interest sake, a pilot study has been executed (Broders & Crossley, 2018), in which participants were given a mirror flipped text, and then they were asked the deliberate questions. To clarify, a mirror flipped text is a text, that is flipped, as if you would stand in front of a mirror and hold the text in such a way, that it reflects to you, and you must try and read the text shown in the mirror. You will have to read the text from the right to the left-hand side, while all the letters are also flipped (Casasanto & Bottini, 2014). The idea is that the flipped orthography will also manipulate towards what direction the mental timeline flows, and therefore will affect the laterality effect found amongst handedness and temporal reference.

Further studies regarding the laterality effect in handedness could also include investigating handedness amongst languages that have a right to left orthography. The hypothesis here would be, that those languages would show a laterality effect flowing in the opposite direction. In other words, the past would be gestured with the right hand and the future would be gestured with the left hand. Languages falling into this rubric would be Arabic and Hebrew (Ouellet, Santiago, Israeli & Gabay, 2010). And again, the mirror reading task can be applied, to see if

the directional flow of time in the laterality effect can be altered. These results would also allow researchers to evaluate causality.

This mirror reading priming can also be additional research to the spontaneous gestures, where participants would have to read the stories mirror flipped, and then retell them to their partners. This could be executed with both Afrikaans first language, English first language, and Afrikaans and English bilinguals, while also looking at languages that flow into the opposite direction, as mentioned above, Arabic and Hebrew. One could also add the priming effect of reversed writing, in which the participant writes in reversed orthography and is then either asked the questions or must retell the stories. In the former, the participant would get a text that they have to write down in reversed orthography, or in the latter, they would have to write the story they will retell in reversed orthography and then retell it to their partner. The first study that was done, with reversed writing exercises did not show a significant effect of reversed orthography (Crossley, 2018:90-93). Yet, further studies and research need to be done, before setting a concluding statement to the effects of reversed writing exercises.

Overall, the aims of this study have been reached, the research questions have been answered and new findings have been made. It contributes to the current research found in temporal cognition research and further findings are bound to be made. Limitation are always present in a study, of which the ones in this study have been mentioned, with possible solutions accompanying them. This leads to many ideas for further possible research in the field of temporal gestures, the mental timeline, handedness in relation to the axis and the handedness effect, and the inclusion of mirror reading and writing exercises. It is also of importance, that languages with opposing temporal flow with regards to orthography and the mapping of time onto space, is further investigated in the near future.

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7. Appendices

7.1. Appendix A: Consent form

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STELLENBOSCH UNIVERSITY

CONSENT TO PARTICIPATE IN RESEARCH

The study of temporal gestures of first language Afrikaans speakers.

You are asked to participate in a research study conducted by Linda-Vanessa Sabine Broders (MA Psycholinguistics), from the General Linguistics Department at Stellenbosch University. These results will be contributed to research paper, thesis or dissertation. You were selected as a possible participant in this study because you have Afrikaans as a first language and can fluently understand and communicate in this language.

1. **PURPOSE OF THE STUDY**

This study is designed to understand how persons with Afrikaans as a L1 use temporal gestures to speak about past and future events. This will make clear what influence language, experience and thought have on each other and what influences temporal gestures compared to studies of other languages.

2. **PROCEDURES**

If you volunteer to participate in this study, we would ask you to do the following things:

Questionnaire

You will be asked to fill out a questionnaire about your language and handedness capabilities.

Interview

After you qualify to take part in the study, you will be given a one hour time slot to choose from in which you will meet the researcher who will be conducting an interview with you. You will only be subjected to one interview. This will take place in one of the lecture rooms in the BA building located on Ryneveld street Stellenbosch. You will be video recorded and audio recorded for this exercise and do have the option of not giving consent for the video and audio recording.

3. **POTENTIAL RISKS AND DISCOMFORTS**

There will be no potential risks or discomforts during the interview. If needed, slight perception during the interview might be applied in order to collect unbiased data.

4. **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

There will be no reimbursement or any benefits when you take part in this study.

The field of linguistics can benefit from this study to further understand the relationship between language and body language, more specifically in the connection between temporal gestures and the Afrikaans language.

5. **PAYMENT FOR PARTICIPATION**

You will not receive any payments or monetary reward for partaking in this study.

6. CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of only me and my supervisor having access to the electronic questionnaires. These questionnaires will be kept on an online storage to which only my supervisor and I will have access to.

7. PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Linda-Vanessa Sabine Broders (0734139221 – 18169473@sun.ac.za) and Prof Emanuel Bylund (0218082006 - mbylund@sun.ac.za).

9. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to me by Linda-Vanessa Sabine Broders in English and I am in command of this language or it was satisfactorily translated to me. I was given the opportunity to ask questions and these questions were answered to my satisfaction.

I hereby consent voluntarily to participate in this study. I have been given a copy of this form.

_____ _____

Name of Subject/Participant Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [*name of the subject/participant]*. *[H*e/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in [*Afrikaans/*English*] and no translator was used.

_____ _____

Signature of Investigator Date

7.2. Appendix B: Language Questionnaire

Language Background Questionnaire

Age: _____

Gender: _____

(1) Please indicate which language(s) you speak and rate your proficiency in each one of them, using the following scale:

1 < - - - - - - 2 - - - - - - -3 - - - - - - 4 - - - - - - > 5

Rudimentary Excellent

Language: _____ Self-rated proficiency (1-5): _____

Language: _____ Self-rated proficiency (1-5): _____

Language: _____ Self-rated proficiency (1-5): _____

Language: _____ Self-rated proficiency (1-5): _____

(2) Please indicate how often you use these languages in your everyday, oral communication, using the following scale:

1 < - - - - - - 2 - - - - - - -3 - - - - - - 4 - - - - - - > 5

Seldom Almost all the time

Language: _____ Frequency of use (1-5): ____ Hours per week_____

Language: _____ Frequency of use (1-5): _____ Hours per week_____

Language: _____ Frequency of use (1-5): _____ Hours per week_____

Language: _____ Frequency of use (1-5): _____ Hours per week_____

(3) Which language(s) did you learn first, that is, as a baby? _____

(4) If you speak any other languages than the one(s) you learnt first, please indicate which ones, where you learnt them (e.g., school, playground etc.) and at what age you learnt them.

Language: _____ Where it was learnt: _____ Age of learning: _____

Language: _____ Where it was learnt: _____ Age of learning: _____

Language: _____ Where it was learnt: _____ Age of learning: _____

Language: _____ Where it was learnt: _____ Age of learning: _____

7.3. Appendix C: Edinburgh Handedness Inventory

Multilingualism and Cognition Laboratory

Department of General Linguistics

Stellenbosch University

Hand Dominance Questionnaire

Participant Information

Name		Email address	

Tasks

Which hand do you prefer to use when…	Right hand strongly preferred	Right hand preferred	No preference	Left hand preferred	Left hand strongly preferred
Writing	☐	☐	☐	☐	☐
Drawing	☐	☐	☐	☐	☐
Throwing	☐	☐	☐	☐	☐
Using scissors	☐	☐	☐	☐	☐
Using a comb	☐	☐	☐	☐	☐
Using a toothbrush	☐	☐	☐	☐	☐
Using a knife (without a fork)	☐	☐	☐	☐	☐
Using a spoon	☐	☐	☐	☐	☐
Using a hammer	☐	☐	☐	☐	☐
Using a screwdriver	☐	☐	☐	☐	☐
Using a tennis racket	☐	☐	☐	☐	☐
Using a knife (with a fork)	☐	☐	☐	☐	☐
Using a cricket bat (lower hand)	☐	☐	☐	☐	☐
Using a golf club (lower hand)	☐	☐	☐	☐	☐
Using a broom (upper hand)	☐	☐	☐	☐	☐
Using a rake (upper hand)	☐	☐	☐	☐	☐
Striking a match (match)	☐	☐	☐	☐	☐
Opening a box (lid)	☐	☐	☐	☐	☐
Dealing cards (card being dealt)	☐	☐	☐	☐	☐
Overall Rating (for the investigator only)					

7.4. Appendix D: First consent form given to participants

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jou kennisvennoot • your knowledge partner

STELLENBOSCH UNIVERSITY

CONSENT TO PARTICIPATE IN RESEARCH

The study of storytelling of first language Afrikaans speakers.

You are asked to participate in a research study conducted by Linda-Vanessa Sabine Broders (MA Psycholinguistics), from the General Linguistics Department at Stellenbosch University. These results will be contributed to the thesis. You were selected as a possible participant in this study because you have Afrikaans as a first language and can fluently understand and communicate in this language.

10. **PURPOSE OF THE STUDY**

This study is designed to understand how persons with Afrikaans as a L1 retell stories. This will make clear what influence language, experience and thought have on each other.

11. **PROCEDURES**

If you volunteer to participate in this study, we would ask you to do the following things:

Questionnaire

You will be asked to fill out a questionnaire about your language and handedness capabilities.

Interview

After you qualify to take part in the study, you will be given a one hour time slot to choose from in which you will meet the researcher who will be conducting an interview with you. You will only be subjected to one interview. This will take place in the Multilingualism and Cognitions Lab in the BA building located on Ryneveld Street Stellenbosch. You will be video recorded and audio recorded with your consent and do have the option of not giving consent to be recorded.

The video recordings will not be used for any other study except for my own particular study. It will not be distributed or shared with anyone else for any other data collection or research. The video recordings will be kept for five years but will not be distributed or used for any other study, and will be destroyed after five years.

12. **POTENTIAL RISKS AND DISCOMFORTS**

There will be no potential risks or discomforts during the interview.

13. **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

There will be no reimbursement or any benefits when you take part in this study.

The field of linguistics can benefit from this study to further understand the relationship between language and thought.

14. **PAYMENT FOR PARTICIPATION**

You will not receive any payments or monetary reward for partaking in this study.

15. CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of only me and my supervisor having access to the electronic questionnaires. These questionnaires will be kept on an online storage to which only my supervisor and I will have access to.

16. PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

17. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Linda-Vanessa Sabine Broders (0734139221 – 18169473@sun.ac.za), Prof Emanuel Bylund (0218082006 - mbylund@sun.ac.za) and Jenna Crossley (17402468@sun.ac.za).

18. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to me by Linda-Vanessa Sabine Broders in English and I am in command of this language or it was satisfactorily translated to me. I was given the opportunity to ask questions and these questions were answered to my satisfaction.

I hereby consent voluntarily to be video recorded for this study:

The video recordings will not be used for any other study except for my own particular study. It will not be distributed or shared with anyone else for any other data collection or research. The video recordings will be kept for five years but will not be distributed or used for any other study, and will be destroyed after five years.

☐ YES

☐ NO

I hereby consent voluntarily to participate in this study. I have been given a copy of this form.

_____ _____

Name of Subject/Participant Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [*name of the subject/participant]*. *[H*e/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in [*Afrikaans/*English*] and no translator was used.

_____ _____

Signature of Investigator Date

7.5. Appendix E: Second consent form given to participants

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jou kennisvennoot • your knowledge partner

STELLENBOSCH UNIVERSITY

CONSENT TO PARTICIPATE IN RESEARCH

The study of temporal gestures of first language Afrikaans speakers.

You are asked to participate in a research study conducted by Linda-Vanessa Sabine Broders (MA Psycholinguistics), from the General Linguistics Department at Stellenbosch University. These results will be contributed to the thesis. You were selected as a possible participant in this study because you have Afrikaans as a first language and can fluently understand and communicate in this language.

19. **PURPOSE OF THE STUDY**

This study is designed to understand how persons with Afrikaans as a L1 use temporal gestures to speak about past and future events. This will make clear what influence language, experience and thought have on each other and what influences temporal gestures compared to studies of other languages.

20. **PROCEDURES**

If you volunteer to participate in this study, we would ask you to do the following things:

Questionnaire

You will be asked to fill out a questionnaire about your language and handedness capabilities.

Interview

After you qualify to take part in the study, you will be given a one hour time slot to choose from in which you will meet the researcher who will be conducting an interview with you. You will only be subjected to one interview. This will take place in the Multilingualism and Cognitions Lab in the BA building located on Ryneveld Street Stellenbosch. You will be video recorded and audio recorded with your consent and do have the option of not giving consent to be recorded.

The video recordings will not be used for any other study except for my own particular study. It will not be distributed or shared with anyone else for any other data collection or research. The video recordings will be kept for five years but will not be distributed or used for any other study, and will be destroyed after five years.

21. **POTENTIAL RISKS AND DISCOMFORTS**

There will be no potential risks or discomforts during the interview. Slight deception during the interview was applied in order to collect unbiased data. Participants are enlightened after the experiment and are given this final consent form to either accept taking part in the study or in order to pull out of the study.

22. **POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY**

There will be no reimbursement or any benefits when you take part in this study.

The field of linguistics can benefit from this study to further understand the relationship between language and body language, more specifically in the connection between temporal gestures and the Afrikaans language.

23. **PAYMENT FOR PARTICIPATION**

You will not receive any payments or monetary reward for partaking in this study.

24. CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of only me and my supervisor having access to the electronic questionnaires. These questionnaires will be kept on an online storage to which only my supervisor and I will have access to.

25. PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

26. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Linda-Vanessa Sabine Broders (0734139221 – 18169473@sun.ac.za), Prof Emanuel Bylund (0218082006 - mbylund@sun.ac.za) and Jenna Crossley (17402468@sun.ac.za).

27. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to me by Linda-Vanessa Sabine Broders, in English, and I am in command of this language or it was satisfactorily translated to me. I was given the opportunity to ask questions and these questions were answered to my satisfaction.

I hereby consent voluntarily to be video recorded for this study:

The video recordings will not be used for any other study except for my own particular study. It will not be distributed or shared with anyone else for any other data collection or research. The video recordings will be kept for five years but will not be distributed or used for any other study, and will be destroyed after five years.

☐ YES

☐ NO

I hereby consent voluntarily to participate in this study. I have been given a copy of this form.

_____ _____

Name of Subject/Participant Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [*name of the subject/participant]*. *[H*e/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in *English* and no translator was used.

_____ _____

Signature of Investigator Date

7.6. Appendix F: Instructions

Instruksies

Lees asseblief die instruksies deeglik deur!

Drie stories is omgedraai vir elkeen gegee.

Eerste Storie

1. Jy kry 1 minuut om om te draai en jou eerste storie deur te lees en bekend te raak daarmee. Jou ondersoeker sal jou laat weet wanneer die 1 minuut begin en eindig.
2. Vertel jou storie in die EERSTE PERSOON.
3. Vertel jou storie in beurte, met ander woorde, vertel jou eerste storie oor, daarna vertel jou maat sy/haar storie oor.

Tweede Storie

1. Jy kry 1 minuut om om te draai en jou tweede storie deur te lees en bekend te raak daarmee. Jou ondersoeker sal jou laat weet wanneer die 1 minuut begin en eindig.
2. Vertel jou storie in die EERSTE PERSOON.
3. Vertel jou storie in beurte, met ander woorde, vertel jou tweede storie oor, daarna vertel jou maat sy/haar storie oor.

Derde Storie

1. Jy kry 1 minuut om om te draai en jou derde storie deur te lees en bekend te raak daarmee. Jou ondersoeker sal jou laat weet wanneer die 1 minuut begin en eindig.
2. Vertel jou storie in die EERSTE PERSOON.
3. Vertel jou storie in beurte, met ander woorde, vertel jou derde storie oor, daarna vertel jou maat sy/haar storie oor.

As jy enige vrae het, vra asseblief!

Sterkte ☺

Instructions

Please read through the instructions thoroughly!

You are each given three stories, facing down in front of you.

First Story

1. You are given 1 minute to turn around and read through your first story and familiarise yourself with it. Your investigator will let you know when the 1 minute starts and ends.
2. Retell your story in FIRST PERSON.
3. Retell your story in turns, i.e. you retell your first story, then your partner retells hers/his.

Second Story

1. You are given 1 minute to turn around and read through your second story and familiarise yourself with it. Your investigator will let you know when the 1 minute starts and ends.
2. Retell your story in FIRST PERSON.
3. Retell your story in turns, i.e. you retell your second story, then your partner retells hers/his.

Third Story

1. You are given 1 minute to turn around and read through your third story and familiarise yourself with it. Your investigator will let you know when the 1 minute starts and ends.
2. Retell your story in FIRST PERSON.
3. Retell your story in turns, i.e. you retell your third story, then your partner retells hers/his.

If you have any questions, please ask!

Good luck 😊

7.7. Appendix G: Warm up stories

Story 1:

Jy staan op en trek jou groen baadjie aan, gryp die grammofoon en die plaat terwyl jy haastig na buite stap. Die lug is skerp en skoon. Die naguil volg jou met sy oë, terwyl jy oor die bruggie stap en probeer onthou wanneer laas daar water in die Gatsrivier was. Jou pa was altyd oortuig dat die rivier nie bedoel was vir kinders nie. Hoekom, weet jy nie. Jy kan die grond voel kraak onder jou sandale en jy stap al vinniger. Die grammofoon is swaar.

Story 2:

By die huis het jy ‘n microwave dinner geëet terwyl jy sitkoms gekyk het waarvoor niemand gelag het nie. In die koulike bed het jy nagmerries gekry van die dag toe jy as kind in ’n springkasteel saam met drie van jou maatjies oor die N1 gewaai is. Dan het jy net geskreeu. Jy het ontnugterd wakker geword en net infomercials gekyk tot jy in die skemer opgestaan het om vir jou Fruit Loops vir ontbyt te gaan ingooi.

7.8. Appendix H: Stories

Deictic spatial-metaphor

Future

English

Your mother said, that *in the near future,* you should get a mirror. You think, that you can look at your top half in the bathroom mirror and you see your feet any time in the shoe store. *Looking forward into the future*, she wants you to see your whole outfit. So, *tomorrow* you will head out and buy one. You start wondering, whether there might be more to your mother's request than she leads on. Suppose, she thinks you have no fashion sense? She says, that's not it. A *long time from now*, you will appreciate having a full-length mirror.

Afrikaans

Jou ma het gesê dat jy in die *nabye toekoms* 'n spieël moet kry. Jy dink dat jy na jou boonste helfte in die badkamer se spieël kan kyk en jy sien jou voete enige tyd in die skoenwinkel. *Met die oog op die toekoms*, wil sy hê jy moet jou hele uitrusting sien. So, *môre* sal jy uitgaan en een gaan koop. Jy begin wonder of daar dalk meer aan jou ma se versoek is as wat voorkom. Veronderstel sy dink jy het geen modekennis nie? Sy sê dit is nie so nie. *'n lang tyd van nou af* sal jy 'n lang spieël waardeer.

Past

English

When you were younger, the ice on the river wasn't this thin. *Way back then*, you were still able to skate on the rivers. The birds never used to go this far north. *Yesterday*, you and your father watched as they came in. You were thinking that *many years back*, there used to be more ice on earth. But you will never experience such an amount of ice in your life time. Although, this makes you want to *go back in time*, you decide to enjoy these last few winters.

Afrikaans

Toe jy jonger was, was die ys op die rivier nie so dun nie. *Destyds* kon jy nog op die riviere ysskaats. Die voëls het nooit voorheen so ver noord gegaan nie. *Gister* het jy en jou pa gekyk toe hulle ingekom het. Jy het gedink dat daar *baie jare gelede* meer ys op aarde was. Maar jy

sal nooit so 'n groot hoeveelheid ys in jou lewe ervaar nie. Alhoewel dit jou laat wens *om terug te gaan in tyd*, besluit jy om hierdie laaste paar winters te geniet.

Sequence spatial metaphor

Future

English

Looking ahead into the future, holed up in this place, you are not able to stay any longer. It's your birthday *in a few days' time*, marking 21 years. In the *two weeks coming*, you are not going to spend them hiding in this place. *Thinking ahead*, the temperature is going to dip, so you hope you will get some winter clothing that you are able to *give to your children one day*. If they take care of them, then *their children* could also have a use for them.

Afrikaans

As jy *vooruit kyk na die toekoms*, opgesluit in hierdie plek, kan jy nie langer bly nie. Dit is jou verjaardag *oor 'n paar dae*, dit merk 21 jaar. In die *twee weke wat kom*, gaan jy hulle nie spandeer deur in hierdie plek weg te kruip nie. *As jy vooruit dink*, weet jy die temperatuur gaan sak, so jy hoop jy sal wintersklere kry wat jy *eendag aan jou kinders kan gee*. As hulle dit oppas, dan kan *hul kinders* ook daarvan kan gebruik maak.

Past

English

Your dad's generation smelled of cigarettes. *Your grandfather's generation* smelled like whisky. *Your grandfather's generation before that* smelled of citrus. The men in your family believe that a person's personality can be smelled miles away. They used to give you perfumes, *way back then* when their salary was still good. Living in the past has never been from one pay check to the next, which makes you want to *move back in time*, so you could have bought yourself whatever you wanted, whenever you wanted.

Afrikaans

Jou pa se generasie het na sigarette geruik. *Jou oupa se generasie* het soos whisky geruik. *Jou oupa se generasie voor dit* het na sitrus geruik. Die mans in jou familie glo dat 'n persoon se persoonlikheid myle weg geruik kan word. Hulle het altyd vir jou parfuum gegee, *destyds toe*

hulle salaris nog goed was. Lewe in die verlede was nooit van een loon na die volgende nie, wat jou laat wens *om terug te beweeg in tyd*, sodat jy vir jouself kon gekoop het wat jy wou, wanneer jy wou.